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AN ACCOUNT OF A NEW GENUS OF MINUTE PAUROPOD MYRIAPODS.

BY JOHN A. RYDER.

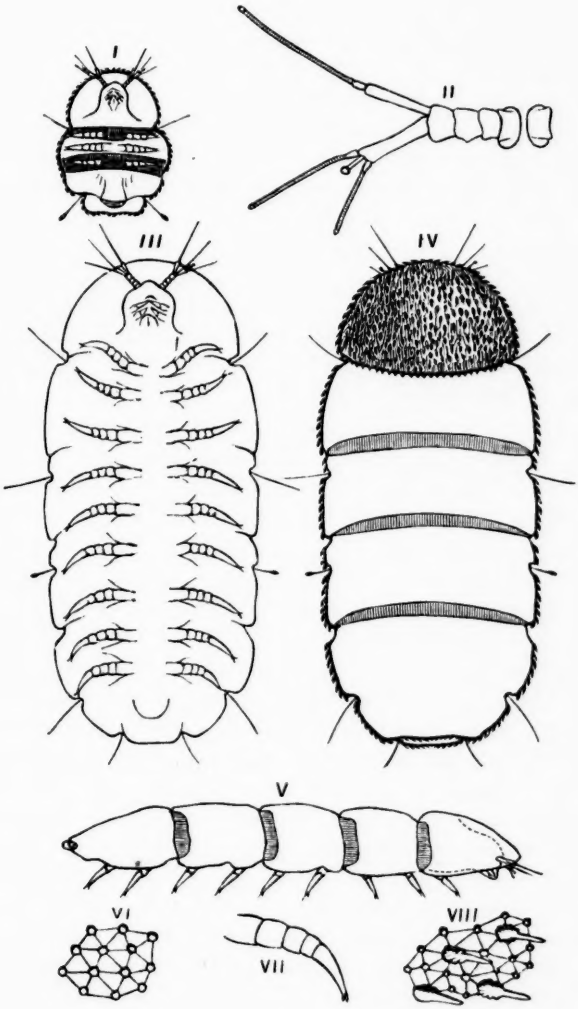
IN 1866 Sir John Lubbock first called attention to the remarkable little myriapod which he named *Pauropus* in reference to the fewness of its feet. He discovered the animal in considerable numbers under decaying leaves; he did not consider it exactly social in its habits; not noticing each other's presence, they did not exhibit the extreme ferocity toward each other which characterize some of the large carnivorous myriapods. In specimens of the same genus, however, which I found in Fairmount Park, Philadelphia, in the nests of *Termes flavipes*, upon two occasions, I noticed that when the point of a dissecting needle was carefully brought into contact with them so as to not injure their delicate little bodies, they would throw their heads around towards the offending needle point and "show fight" like the species of the carnivorous genus *Lithobius*. This was not noticed in the specimens of *Eurypauropus* which I am about to describe, and which I kept in confinement for about three months; in fact, the "bustling, active, neat and cleanly" little *Pauropus* is in strong contrast with the former in the two first particulars. The habitat of the new American form is much the same as that of *Pauropus*, being found in moist situations under sticks and decaying vegetable matter, and like it appearing to respire through the skin, so that if placed in a dry atmosphere it soon dies. None of the members of this group attain a large size, *P. huxleyi* being about $\frac{1}{20}$ of an inch long, which is about the size of the new form, whilst *P. pedunculatus* and *lubbockii* are both smaller.

Upon the occasion when Sir John Lubbock first exhibited his

then new species at the meeting of the Entomological Society of London, "Mr. Westwood remarked that, with the exception of the genus *Japyx*, described by Mr. Halliday, *Pauropus* was the most interesting addition to the Articulata which had been made for many years." This high degree of interest attaches to the discovery of *Pauropus* on account of the remarkable characters which it presents, and which constitutes it one of those types known to systematists as *synthetic* or *comprehensive*, that is, it embodies characters found in several forms widely removed from each other in the system. In the form of the body and legs the creature recalls the large carnivorous myriapods or centipedes, whilst in the possession of a pulvillus or pad, and a claw on the feet, they resemble in a measure true insects; in their branched antennæ they resemble crustaceans, and in their herbivorous habits they resemble the herbivorous, and in the distribution of the legs they combine characters of both the herbivorous and the carnivorous myriapods.

Sir John believes, after reviewing the opinions of the most distinguished naturalists, that the group must be considered a class having the same systematic value as that of similar subdivisions of the animal kingdom, and in view of the singular assemblage of characters presented by *Pauropus*, he thinks it necessary to erect a new order under the name of *Pauropoda* with a family *Pauropodidæ;* this arrangement would then cause the class to fall into three apparently natural groups.

To the three known species of the order *Pauropoda*, it gives us pleasure to add a fourth, so widely different from all others hitherto described as to leave no doubt as to the propriety of erecting a new genus for its reception. This singular form was discovered by myself in the month of April of the present year, in East Fairmount Park, in company with my friend, Mr. D. S. Holman. Upon that occasion five specimens were obtained, which formed the basis of the description of the genus published in the Proceedings of the Academy of Natural Sciences of Philadelphia shortly afterwards. Not long after, in an excursion with the same gentleman, I found five more specimens in West Fairmount Park, on the west side of the Schuylkill river, perhaps a mile from the first locality, which I succeeded, as stated before, in keeping alive until the middle of July last; having produced young whilst in confinement under such circumstances as to leave no doubt that



EURYPAUROPUS SPINOSUS, RYDER.

they were the parents and consequently that they were adults, having undergone no change meanwhile.

The new form, which in several respects differs in a remarkable degree from *Pauropus*, I have called *Eurypauropus* in reference to its great relative width. The antennæ are five-jointed as in *Pauropus*, but the proportions of the terminal many-jointed filaments are different. These filaments in minute structure are very similar to those of the old genus, being composed of saucer-like disks, which are superimposed in a linear series and united at their centers to each other by delicate but very short pedicels. These like the similar filamentous organs of *Pauropus*, I found could be studied very well with a power of 1000 diameters, as they measure little over $\frac{1}{300}$ of a millimeter in thickness or about $\frac{1}{7500}$ of an inch. The antennæ are inserted close together at the front of the head with a very narrow bridge of chitin intervening between them as shown in Fig. II. The outer branch bears two of the many-jointed filaments, between the bases of which arises a pedicel surmounted by a globular or ovoid semi-transparent body with linear sepaliform processes clasping it (but which are not shown in the figure), much as in *Pauropus pedunculatus*.

The body is composed, apparently, of six segments; there is a possibility that the head is composed of two, in which case there would be seven in all, but the most careful focusing failed to reveal more segments than the number stated above. The first or head segment is wide and broadly rounded at its anterior margin, and overhangs the head like a hood or shield with descending borders, from beneath which the ends of the antennæ project forward in a remarkable manner. The head is partly free, a large vacant space appearing on either side and in front of it between it and the free hood-like head shield or segment, the surface of which, as well as that of all the others, is covered with small tubercles and spines, as shown much enlarged in Figs. VI and VIII, whilst its margins, as well as that of all the others are fringed with hooks or spines directed backwards, as shown in Figs. I and IV. There are no other appendages belonging to the head segment except the first pair of legs, which seem a little shorter than those following. Between the first segment and the second there arises on each side a simple hair, which appears to be attached to the second segment, which is more than twice as wide as long,

and is overlapped in a peculiar way by the first, as seen in the diagrammatic side view of the animal in Fig. v, where the other segments are seen to overlap each other in succession in a similar manner. The third segment, of nearly similar proportions, has a notch in each lateral margin from which a simple hair arises as in the preceding segment. The fourth segment is very similar to the preceding in proportions, and is notched laterally in the same way, but from the notches on either side there arises a hair ending in a bulbous extremity. The fifth segment is somewhat like the first in form, but has a notch at either side from which there arises a simple hair, and it is truncate behind, the truncated part exceeding very slightly in width the diminutive sixth segment, which is nearly hidden beneath the fifth. On either side of the sixth segment, from a depression, there arises a short hair about half as long as the hair preceding.

I am led to surmise that the notches at the sides of the third, fourth and fifth segments of the adult possibly indicate that these were primitively compound, and in reality represent two segments fused together, which would make nine in all, counting the others as single; this view, though, evidently is not without objection, as there is quite as much ground for a belief that the others are equally as compound. From this point of view the structure of *Eurypauropus* becomes of the highest interest to the morphologist as representing the most extreme point in the reduction of the number of segments in myriapods. It is in fact *Pauropus* with the number of legs characteristic of that genus, but with a number of its segments obliterated by becoming apparently fused together and otherwise modified.

Two pairs of legs are attached to each of the second, third, fourth and fifth segments, which, with the single pair in the first segment, make nine in all. The legs are completely concealed from above, in life, by the lateral expansion of the body segments as in *Pauropus*, but the expansions are not composed simply of chitinous pleural pieces as in the latter, but the thin yielding whitish ventral body wall extends almost to the very margins of the segments. The joints of the legs are composed of thicker rings of chitin than in *Pauropus*, and the only portion of the creature where a thin chitinous body wall is apparent, as in the old genus, is about the head and belly. There is also no evidence of segmentation to be found here, the covering seeming to

be continuous from the head to the anal extremity, except at the points where the mouth and vent are situated. The mouth parts seem to be very similar to those of *Pauropus*, though in view of the fact that it has been very difficult to get a satisfactory view of the head portion of the animal, I will not be too explicit in my remarks on this head. The anal opening is guarded below and anteriorly by a semicircular plate of chitin, shown in Fig. III, on the under side of the posterior extremity of the fifth body segment. No evidence of tracheal openings has been observed. Eyes seem to be wanting, indeed the manner in which the first segment overhangs the head, would lead one to suppose that vision would be obstructed, rendering eyes useless; then the remarkable antennary structure may, in a great measure, replace the eyes; and it is difficult to understand the use of the pedunculate hyaline body unless it be auditory. May it not be that the Pauropoda as well as some Diplopods are blind? *Polyxenes*, I am convinced, is provided with very delicate tractile organs at the extremity of the antennæ, and Bode figures minute auditory organs on the head behind its glossy black eyes. It seems to me, therefore, probable, that the multi-articulate, terminal filaments of the antennæ of Pauropods are probably for the most part tactile, whilst the hyaline bodies are wholly or in part auditory in function.

The *larvæ*, of which I possess two specimens, yield no better evidence as to the composite nature of the head segment than the adults; the total number of visible segments in the young seems to be three with uncertain indications of a fourth. The evidence that these larvæ are the offspring of the adults which I had kept in captivity, is complete, having been taken from a chink in a bit of decayed wood into which the adults were repeatedly seen to crawl during the three months of their confinement. Moreover, the chitinous shells of the ova from which the young had escaped, were found in the same cranny. The larval *Eurypauropus*, Fig. I, is exceedingly depressed, more so relatively than the adult, and appearing on this account very much like a young *Cimex*, or bed-bug, and having much the same relative proportions, viz: $\frac{1}{63}$ of an inch long by $\frac{1}{83}$ of an inch wide, but altogether smaller. It presents the same peculiar features in the sculpture of the upper surface of its body segments as the adult, but the tubercles and spines are not as strongly developed, but the marginal serratures

are well marked. The thickness of the dorsal chitinous pieces of the segments is much less than in the adult, and hence the animal is much more transparent. From each side, and where the head segment joins the succeeding one, there arises a simple hair as in the adult, and from each side posteriorly at the points where the third and the fourth segments join there arises a clubbed hair. The legs are six in number, as is usual in larval myriapods, and appear to be confined entirely to the second segment, and have the same number of joints as those of the adults. The antennæ are of the same form and proportion as in the adult, and have similar terminal appendages. The mouth parts are likewise similar, and the wide free border of the head segment extends forwards and downwards anteriorly beyond the head, the same as in the full grown ones. The young, as would naturally be inferred, are very much paler in color than the old ones, and are of a pale reddish-white or lilac tint, whilst the adults are of an isabeline or pale rusty-red color, the closely set appressed spines on the back giving them a perceptible silky lustre when observed with reflected light; they are much paler below. Their color when viewed with transmitted light, is pale brown, due to the chitin of the body walls. It will be readily seen that the contrast in color between the new form and *Pauropus*, which is almost white, is very great, and sufficient to constitute, with its other features, a very important distinction.

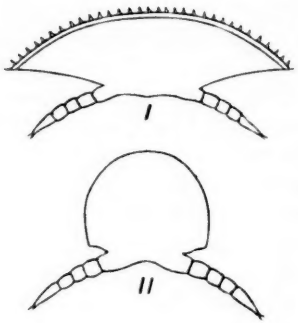
The internal anatomy of the new genus I have not yet been able to work out satisfactorily, owing mainly to the want of an abundance of material wherewith to prosecute the investigation, and also not less on account of the want of proper methods. These latter I think I will soon be able to apply. The entire bulk of the animal is perhaps three times that of *Pauropus*, and is therefore better adapted for anatomical study than the latter.

In habit *Eurypauropus* is much more sluggish than *Pauropus*, and does not scamper away into the nearest crevice like the latter when its haunts are exposed to the light. The specimens which I kept in confinement were placed in a wide-mouthed ounce vial, half filled with moist earth and corked up, into which I had placed some fragments of rotten wood, under which the animals could retreat; in this close place the animals lived for the time I have before stated. In physiognomy they much resemble diminutive sow-bugs, and they also resemble these in the choice

of habitat they make, But all of the specimens I have yet collected were taken from the under side of fallen limbs in damp, shady situations on the ground, not under the bark of trees.

Eurypauropus in some respects is a good deal like *Polyxenes*[1] in the shape and superficial ornamentation of its segments, but the dorsal serrate plumes and caudal fascicles of hooked bristles are deciduous in the latter, and may be readily brushed off, which is not the case with the tubercles and spines of the former.

In view of the fact that *Eurypauropus* differs from *Pauropus* in the same way that *Polydesmus* differs from *Julus*, in having the legs concealed by the lateral expansion of the body segments, as shown in the accompanying cut, where Fig. I represents a diagrammatic cross-section of *Eurypauropus* and Fig. II the same of *Pauropus*, as well as in having the head overhung by the anterior, lateral and downward production of the chitinous shield-like first segment, and that it has fewer segments than any other species of Myriapod, I venture to consider it a family under the name of *Eurypauropodidæ*. The following revision of the order becomes accordingly necessary.



PAUROPODA, Lubbock, Trans. Linn. Soc., XXVI, p. 181.

Body composed of 6–10 segments, convex or depressed, with scattered hairs or tubercles and spines. Antennæ five-jointed, bifid, bearing three long, jointed appendages. Nine pairs of legs; feet with a claw and pulvillus. Herbivorous.

I. PAUROPODIDÆ, Lubbock, l. c.

Segments ten, the chitinous annuli of which are circular

[1] Adverting to *Polyxenes*, I find that its eggs are usually more or less entangled in a felt composed of the caudal bristles, which is, no doubt, a protection against the ravages of the long-snouted mites, and I also find that the singular barbed hooks of these bristles in *P. fasciculatus* Say, are different in form from those of *P. lagurus* of Europe, according to the recent figures of Bode.

Prof. Leidy has recently informed me that he has lately found *P. fasciculatus* at Easton, Pa., which is the fourth locality known to me for this species, making its present distribution extend from Massachusetts to Georgia.

in section with very thin walls and without superficial sculpture. Head not concealed by the forward and lateral production of an anterior segment. Legs not concealed. White. With eyes.

1. *Pauropus huxleyi*, Lubbock, l. c.

Hyaline body of the outer ramus of the antennæ sessile. Length $\frac{1}{20}$ inch. Hab. England and E. Penna.

2. *P. lubbockii*, Packard, Proc. Bos. Soc. Nat. His., XIII, p. 409.

Hyaline body pedunculate but shorter than in the next. Length, .03 inch. Hab. Salem (Packard) and Chelsea (Walker), Mass.

3. *P. pedunculatus*, Lubbock, l. c.

Hyaline body on a long peduncle. Length $\frac{1}{25}$ inch. Hab. England.

II. EURYPAUROPODIDÆ.

Segments six, composed dorsally of a thick plate of light-brown chitin, greatly depressed, three times as wide as high, spinose, tuberculate and reticulate on their upper surfaces; margins serrate. Head concealed by the hood-like anterior production of the first body segment. Legs hidden beneath the lateral expansions of the body segments. Reddish. Without eyes.

1. *Eurypauropus spinosus* Ryder, Proc. Acad. Nat. Sci. Phila., 1879, p. 139, and ibid. p. 164. Length $\frac{1}{20}$ inch. Hab. in Fairmount Park, E. Penna.

The discovery of additional species may now be awaited with some confidence, since the distribution of those already known has been so considerably extended by Dr. Packard and myself. Sharp eyes and patient search in quest of these and kindred minute forms will now reward the student with striking new and little known species much more quickly than by collecting the showy and conspicuous insect fauna of his neighborhood. It was probably the keen-sightedness developed by the experience of Sir John Lubbock in patiently collecting the *Thysanura* that led him to detect and scrutinize *Pauropus*, leading to its recognition as an important new type.

EXPLANATION OF THE PLATE.

FIG. I.—Larva of *Eurypauropus spinosus*, enlarged fifty times.

FIG. II.—Antenna of adult, enlarged two hundred and fifty times.

FIG. III.—Adult from below, enlarged fifty times.

FIG. IV.—Same from above, the sculpture represented only on the first segment, enlarged fifty times.

FIG. V.—Same from the side, enlarged forty-eight times.

FIG. VI.—Tubercles on the upper surface of the segments near their junction, enlarged two hundred and fifty times.

FIG. VII.—Leg, enlarged fifty times.

FIG. VIII.—Spines and tubercles of the back, enlarged two hundred and fifty times.

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MICROSCOPICAL FUNGI INFESTING OUR CEREALS.[1]

BY WM. BARBECK.

I. Ergot.—In examining a rye-field about harvest time we may be pretty sure to find some plants in which, although the ears with their bracts or glumes are apparently developed in a normal way, some of the grains have attained an abnormal size and are of a somewhat blackish color. We have here what is generally known as "Ergot" (botanically *Claviceps purpurea* Tul.), a fungus which is to be found almost exclusively on rye, and which, because of its poisonous effects on animal organisms, is dreaded, particularly in those parts of Northern Europe where rye bread forms the staple daily food.

This fungus shows three distinct stages of development, two of which were well known to former botanists, but were described as separate species belonging to entirely different genera. It is to Tulasne that we owe the discovery of their immediate connection and succession.

Towards June, when the sexual parts have been differentiated, we see a mucous, honey-like substance flowing from out of the bracts of the ear. In examining this "honey-dew" (as it is called by farmers) under a microscope of high power, we behold it swarming with millions of minute oval spores, or conidia, which upon further examination we find to issue from a delicate but complicated mycelium which penetrates the ovary, gradually transforming it into a soft whitish body of an oblong shape with shriveled surface. In this form our fungus was described and recorded by Leveillé as *Spacelia segetum.*

In the course of a few weeks the gelatinous membranes of the mycelium-threads harden and assume a brownish color. Thus the originally soft tissue is transformed into a body of a corky or

[1] Read before the Biological Section of the Academy of Natural Sciences, Philadelphia.

horny consistence. We now have the so-called "Ergot-grain," or the second stage of development of our fungus, formerly described as *Sclerotium clavus* Tode, and recognized as a good species among the Dermatomycetes. At the top of the "Ergot-grain" we behold the dried and shriveled remains of the *Spacelia* as a sort of hood of a dark-yellowish or brownish color.

In this form of *Sclerotium*, the "Ergot-grains," most of which, of course, fall out of the ears when the corn is taken from the field, remain on the ground unchanged through the winter.

In April of the next year the third and very interesting form, which by its discoverer, Tulasne, has been termed *Claviceps purpurea*, is developed. We behold a number of purplish carpophores, each ending in a yellowish head growing out of the *Sclerotium*. Each of these little heads shows in longitudinal sections a row of regularly shaped and arranged *peridia*. These peridia are filled with a number of *asci* containing the very minute and thread-like spores. Direct experiments made by Prof. Kuehn, of Halle, and other mycologists, have proved beyond doubt that when these spores are sown into healthy young blossoms of rye, they will in a short time produce the mycelium of *Sphacelia*. The same result is sure to be obtained by means of the conidia of the honey-dew, which in a comparatively short time will infect other perfectly healthy ears, and will even carry the disease over to other surrounding plants, such as several species of grass, etc.

Thus we have to regard the *Claviceps* spores as originating the disease in spring; the *Sphacelia* as propagating it during the period of fructification, and the *Sclerotium* as preserving the contagion through the winter.

It is generally known that the ergot when brought into the human organism operates as a narcotic poison. In certain years which were particularly favorable to its development, numerous cases of poisoning have been observed in Europe, and so we learn of a series of ergot epidemics recorded in official European statistics. In 1771, for instance, the disease was so acute in Westphalia and Hanover that in certain villages more than ninety per cent. of the cases proved fatal.

The parasite has acquired its German name "Mutterkorn," because of its contracting effects upon the uterus, owing to which it has become an efficient aid in obstetrics, well known under the old name of *Secale cornutum*.

The ergot in its *Sphacelia* form is, as mentioned before, not confined exclusively to rye, but its conidia infect several species of grass, such as Lolium, Bromus, Dactylis and others. Thus a number of diseases befalling our domestic animals are most probably to be ascribed to the "honey-dew" which the animals have eaten with such infected grasses. Of course the farmer ought to remove the infected plants growing in the neighborhood of his rye fields. He ought to pick out the ergot grains as much as possible before the corn is mown, and as they are only formed during the short period of fructification, he has to apply such methods of cultivating his ground (particularly the drilling) as tend to produce a simultaneous development of the fruits, thus reducing the dangerous period to a comparatively short time.

II. Smuts.—The Ustilagineæ, or smuts, are parasitic fungi whose fine-threaded, wide-spreading mycelium grows through large portions of the infected plants. They fructify, however, only in certain parts of these plants and at certain periods. In such proper places the threads of the mycelium increase rapidly, resorbing the surrounding tissue. Their free ends become divided into cells; the latter, after being separated, are surrounded by a second membrane and thus transformed into spores. These spores occupy as a brownish dust or powder the place of the destroyed tissue, and are set free in a measure as the infected parts decay.

The organs of the plant in which these fungi are fructifying, vary according to the species of smut. So we see the whole panicle of oat infected by *Ustilago carbo*, or "*oat-smut*;" the interior of the wheat grains by *Tilletia caries*, or "*bunt*;" the anthers of several *Sileneæ* by *Ustilago antherarum*, and the female cobs of our maize by *Ustilago maydis*, or *maize-smut*. When in any of these Ustilagineæ the spores are being formed, the threads of the mycelium become dissolved and disappear; consequently when the smut is fully developed we shall find nothing but the afore-mentioned spores.

Numerous experiments have shown that these spores maintain their power of germination for several years. When brought on a moist substratum they produce, within a few days, a germ tube or promycelium on which minute sporidia of various shapes, according to the various species of smut, are formed. According to the observations of Hoffmann, Kühn and other eminent

botanists, these sporidia penetrate the epidermis of young and tender corn-stalks, mostly in the region between the root and the first joint of the stem. The mycelium grows in an upward direction, following the course of the longitudinal cells. However, the growth of the plant seems not to be injured; on the contrary, the infected plants are apparently of a more fresh and bluish green, and it is not before the time of fructification that the devastation becomes visible.

The process of germinating is very nearly the same in the oat and maize smut, whereas the "bunt," or *Tilletia caries* shows some interesting peculiarities. In this parasite, which is to be found exclusively within wheat grains, the sporidia are produced in a verticillate manner from the germ tube. They repeatedly anastomose, and this anastomosis, or conjunction, is considered as an act of fructification, for immediately afterwards we see that oöspores are formed, from which very minute threads are sent forth which become free and carry the disease over to other wheat plants.

It requires an experienced eye to discover the bunt in any wheat field, for the infected ears are not distinguished in their outer appearance from the healthy ones. The diseased grains, however, when rubbed between the fingers, burst at the slightest pressure, and we see that instead of the white meal they are filled with a dark smutty mass, which is distinguished by a nauseous smell resembling herring brine, produced by a volatile oil, the trimethylamine, which is also to be found in herrings.

However destructive all these smuts may be, it is within the power of any farmer, if not to prevent at least to limit their excessive increase. The spores have been found adhering in large numbers to the grains which are harvested, and which, of course, when sown in spring, will transmit the contagion to the next crop. Now a solution of copper-vitriol, which is not hurtful to the seeds, is sure to kill the dangerous spores, and so we have an efficacious and at the same time cheap prevéntive remedy on hand.

III. Rusts and Brands.—The parasites of the hitherto described species we have found to be destructive to the several organs of fructification. The following fungi belong to an entirely different genus. They infest and destroy the stem as well as the leaves and vaginæ of our gramineæ and other cultivated plants, and

are generally known under the name of rusts and brands, or *Uredineæ*.

In examining our corn-fields in the beginning of summer we shall most likely find a number of plants covered all over with bright rusty, later in the year with dark brownish spots and lines. These pustules are produced by parasitic fungi which have their seat under the epidermis of the infected plants, and after being developed, burst through the epidermis in order to disseminate their spores. The very interesting development of these Uredineæ is a comparatively recent discovery, the more interesting as the originators of the disease are to be found on plants belonging to families entirely different from those in which the parasites are developed.

If in May or June we examine the leaves of some *Berberideæ*, *Rhamnaceæ* or *Asperifoliaceæ* growing in the neighborhood of our corn-fields (particularly those in damp localities), we may be pretty sure to find the under surface of such leaves covered all over with little cup- or jar-like bodies of a bright-rusty color. These little cups are what have long since been known as cluster-cups, or *Æcidium*. They present an elegant object under the microscope, and delicate sections will show that the interior of the cups is crowded with basidia, from which regular rows of bright-colored spores proceed. (These cluster-cups are generally attended by numbers of those strange little bodies known as spermogonia, growing mostly from out of the opposite side of the leaf, and sending forth thread-like spermatia, the real nature of which has as yet not been ascertained.)

Prof. de Bary, of Strasburg, has been the first to show that when these *Æcidium* spores are brought on certain species of corn, for instance those of *Berberis*, or Barberry, on rye, they immediately begin to germinate. The tender germ tubes force their way through the stomata and rapidly develop within the infected leaf a mycelium from which the afore-mentioned spores are produced on basidia beneath the epidermis. Prof. de Bary was led to the investigation by the pertinacious and often ridiculed assertion of old farmers, that the shrubs of Barberry were injurious to rye and oats; and indeed, his repeated direct experiments, as well as those of a number of other botanists, have proved beyond doubt that a very dangerous form of rust, the *Uredo linearis*, is produced only by the spores of Barberry cluster-cups.

In the same way it has been shown that other rust diseases, for instance, such as are produced by *Uredo rubigo vera*, which also destroys our cereal plants, are originated by certain cluster-cups growing on other plants in the neighborhood of corn-fields.

If we examine the rust-pustules more closely, either by opening them with a needle or by making thin sections, we shall find beneath the epidermis and growing on short peduncles, numerous yellowish spores. They represent simple oval cells, the protoplasm of which contains little drops of an orange-colored oil. The hyaline episporium is granulated and shows several translucent spots, the places from which the germ tubes will proceed. These germ tubes are rapidly developed, often within a few hours. They penetrate the stomata of other leaves and repeat the production, first of a mycelium, then of numerous spores, which again pierce with their germs through the epidermis of other plants. In this way the the process is continued through the course of summer, and it is easily explainable that under favorable circumstances the disease may be propagated from field to field, over vast tracts of land, assuming quite an epidemic character.

Towards the close of the hot season we see our fungi entering a new stage of their development. Repeated examinations of the rusty pustules will show that the latter are gradually transformed into bodies of a dark-brownish color. Let us examine these dark bodies a little closer. We shall find that from the former mycelium spores of a quite different shape and color have been produced. The Uredo or summer spores have disappeared and in their place we behold numerous dark-brownish two-celled spores with thick or perfectly smooth membranes growing on long pedicles. They are what is known as *brand* (*Puccinia*), and were formerly described as an autonomous species of fungi. In reality they are the winter or Teleuto spores of the rust. The spores remain with their peduncles attached to their stroma during the winter, and do not begin their germination before the following spring. Then one or several germ tubes are formed, which at their upper extremities become segmented into several cells. From each of these cells we see growing out a very fine thread, producing a sporidium. These sporidia are set free and are scattered by the wind, and when brought on the leaves of barberry are sure to produce the cluster-cups first described. (The latter fact has again been proved by numerous direct experiments.)

Thus we see the *Æcidium* producing *Uredo*, the *Uredo Puccinia*, and the *Puccinia* again *Æcidium*, and we have the interesting fact, that fungi of an apparently unlike structure, which have been hitherto described as belonging to different genera, and which are actually to be found on entirely different plants, are in reality but sucessive forms of development of the same parasite.

By this discovery of De Bary, the attention of a number of mycologists was directed to other species of rusts. Numerous experiments have been made, and thus the connection of a number of hitherto separated forms has been found out. We know, for instance, that one species of Uredo, *U. straminis*, which destroys the glumes and attacks the ovaries of wheat-ears, and which in 1862, in Denmark, caused a damage of nearly a million of dollars, has its *Æcidium* form on the several *Boragineæ*; that a disease on pear trees, destructive to the young leaves and ovaries, and known as *Rœstelia cancellata*, is the *Æcidium* form of a *Uredo* growing in early spring on *Juniperus* and hitherto described as *Gymnosporangium*.

In some rusts the winter spores present a form at the same time very elegant and quite different from *Puccinia*. So we see towards autumn the under surface of blackberry and rose leaves spotted all over with little blackish powdery tufts of the so-called blackberry brand or *Phragmidium*. These tufts are composed of four or five-celled elegantly granulated spores, produced on long hyaline peduncles. In the same places where we find them now we would have met a month ago the one-celled Uredo spores, and it is quite interesting to observe under a lens from day to day how (beginning at the circumference and moving towards the center) the dark winter spores are gradually superseding those of Uredo. This connection has also been discovered but recently.

In the same way the dimorphism of several other rusts and brands has been defined. However, we are as yet ignorant as to the development of a good many other species, and there is consequently a vast and at the same time highly interesting field left for further investigation.

IV. Mildew.—"Mildew," says M. C. Cooke in his Parasitic Fungi, "is one of those loose terms which represent no definite idea, or a different one to different individuals." It may be so in England; American farmers, however, as well as horticulturists of my acquaintance, unanimously apply the term to the several species

of *Erysiphe*, and so I understand under the name of "mildew" the mycelium of a parasitic fungus which, sometimes very thin and cobweb-like, sometimes in a thick, felty layer, disturbs the development of the infected plant, particularly by obstructing the stomata, perhaps also by drawing its nourishment from out of the infected organs by means of little wart-like processes, through which the mycelium is attached to the plant on which it feeds.

Among the great many varieties of *Erysiphe*, which are to be found on the leaves of different trees as well as on a great many ornamental and useful plants, we have to deal here with one species, *E. graminis*, which in certain years is to be found in abundance, covering the leaves of the several cereals.

The real nature of this parasite has likewise but recently been discovered, and it requires a good microscope to discern the minute organs of fructification.

Soon after the formation of the "mildew" has commenced, we see some of the mycelium-threads growing upwards in a vertical direction. These threads become segmented into several cells; each of these oval cells is separated in the same way as we have seen in Sphacelia, is transformed into a conidium, and by means of these conidia, the mycelium is propagated during the summer months, with incredible rapidity under favorable conditions.

Towards the close of the period of the growth of vegetation we see in a very interesting way that peridia are formed by means of a sexual process.

At the crossing point of two mycelium-threads two cells of a somewhat unlike shape are differentiated. The larger one, issuing from the inferior hypha, is club-shaped. It is (according to De Bary, to whom we are indebted for very careful investigations of this subject) the female "ascogonium," as he terms it, against which the much thinner "pollinarium" (growing up from the inferior hypha) leans closely. The contents of the pollinarium being absorbed by the female organ, the latter begins to swell or enlarge as the pollinarium disappears. In the mean time a number of secondary threads are developed at the basis of the ascogonium. These threads surround and enclose the ascogonium, producing numerous lateral as well as inward growing ramifications. The lateral threads weave themselves into a compact tissue which afterwards hardens, becomes brownish and forms the outer coat of a peridium, while the space between this coat and

the ascogonium is filled up by the loose tissue of the inner ramifications.

The ascogonium is divided by repeated partition into a number of asci, each of which in our species contains eight spores. According to the observations of several botanists, these spores are not developed before the next spring, so that the parasite is preserved through the winter by means of the peridia. In most species of *Erysiphe* these peridia are provided with hyaline appendages, some of which are of wonderful regularity and elegance of form, when seen under the microscope.

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FRESH-WATER ENTOMOSTRACA.

BY C. L. HERRICK.

THE collector of fresh-water specimens is constantly meeting unexpected forms, especially among the smaller organisms, and of these no order of animals furnishes a wider variety or more curious adaptations than the fresh-water Crustaceans embraced in the old group *Entomostraca*, which is by many authors at the present day subdivided into several orders of Crustacea, the name being retained for a single order. To the microscopist particularly they are available as a never-failing field for study, since a cup of water from almost any source will contain abundant material for a day's work.

The Entomostraca have specialized jaws, but the gnathites never exceed three pairs. The segments of the abdomen are devoid of appendages. The name was derived from two words, meaning insect and shell, by Otho F. Müller, and applied by him in his "Entomostraca" (1785) to the animals which had hitherto been all comprised in Linnæus' genus *Monoculus*, named from the supposition that they possess but one eye. This order has, generally speaking, been much neglected, and in America particularly it seems to have escaped attention. The members of this order are never large, and many are so small as to be with the greatest difficulty detected by the unassisted eye, yet from their great variety, wide range and immense number they assume a position of considerable importance in the animal kingdom.

Recent investigations instituted by Mr. S. A. Forbes, of the Illinois State Laboratory of Natural History, have emphasized the fact that the lowly animals play important parts in the economy of nature, he having found that these Crustaceans enter

largely into the diet of fish, even of the larger varieties. The larger portion of the Entomostraca, numerically at least, are vegetable feeders and live on the minute particles of matter floating in the water, which otherwise would tend to render our waters impure. The snails wipe clean the stones and water-plants, and the scavenger fishes remove the carrion, but it remains for minuter forms to search carefully each drop and remove the particles, microscopic even to the thousand eyes of the dragon-fly larva. Thus the *Sida* (Plate III) in swimming uses the branchial feet within the shell-valves, not only in taking the necessary air from the water, but, by creating a counter current between the bases of the feet, particles of food are constantly brought within reach of the jaws. In common with low forms of animals in general, the processes of reproduction are often curiously anomalous. Congress of the sexes is in many cases unnecessary for many generations, and some forms, especially the *Artemia*, or "brine shrimp," seem unusually susceptible to changes in their environment. Males are often produced only in certain seasons of the year or under certain climatic conditions.

In the *Daphnia* the females produce young by simple budding from the ovary, but in the winter the ovum is enclosed between the valves of the carapace, which is removed at each molt, and it is thus enabled to resist the severity of the cold season. Speaking of the molt it is interesting to note that every hair, even to the finest filament, throws off a sheath, so that the cast-off integument is a perfect copy of the animal from which it came. In the higher forms the eggs are carried during the later stages of embryonic existence in double or single sacs extending beneath or on either side of the abdomen. In the *Daphnia* and other forms enclosed in a carapace the animal is oviparous, and the young can be seen within the shell in a cavity above the abdomen for some time before they are sent out to paddle their own crystal canoe. They may be removed from the parent without inconvenience. In the larger sub-division, the *Lophyropoda*, the chief organs of locomotion are one or both pairs of antennæ, though natatorial feet are never wanting. The antennæ also serve as prehensile organs in the *Cyclopoidea*, while the feet throughout the whole legion have branchial filaments.

Every one who has used the microscope has met with some of these animals, and we will mention a few forms. If water, taken from the clear surface of a lake on a sunny day, be carefully ob-

served, often a delicate, transparent animal may be seen darting about in the vessel like a flash of light, or if the lake be shallow and abounds in water plants the related form represented in Plate I may be seen. As it springs from side to side of the jar it seems a living jewel, for the antennæ and abdomen are tipped with varying purple, and the body glows yellow and scarlet, and if the bright-red egg-mass be present it is a conspicuous object. Place it under the microscope with a low power and we can see the long flexible antennæ, and if it is a male the thickened basal joints can be seen terminating in a spine at the thirteenth, where the geniculating joint is situated. The antennules on either side of the head segment, which is distinct from the thorax in this species, and the stylets on the last joint of the abdomen, with their setæ, are noted—when the antennules begin to rotate like the paddles of a steamer, and bending the abdomen and immediately launching a powerful "kick" with the caudal setæ spread out, at the same time that the antennæ beat the water like oars in the hands of an expert, the animal springs out of sight. One instinctively looks for the fellow some yards away, but remembering that the whole animal is little over .06 of an inch long, we again adjust the slide and bring him into view.

More abundant than the *Diaptomus* and better known, is the *Cyclops*. Plate II represents a large species in which the hairs are greatly elongated, especially on the caudal setæ, the longest pair of which resemble feather dusters. The Cyclops has received more than its share of names, owing to the great difference between different stages of its existence. If we place a female Cyclops in a vial, in a few days little specks will be seen swimming about in the water, and the eggs will have disappeared. These specks prove to be the young of Cyclops, but so little like the parent that it requires much faith to believe they will ever assume its likeness. Instead of five pairs of feet there are but three, and as we watch the growth of the animal, these prove to be elementary antennæ and jaws, while the true feet bud out of segments not yet formed. Almost every pool furnishes another example of the *Cyclopoidea* in the *Canthocamptus* which resembles the *Cyclops* greatly, and goes through the same transformations. The body tapers gradually with no marked distinction between thorax and abdomen; the egg-sac too is under the abdomen, and has in connection with it a colorless tube.

Perhaps the next animal to attract our attention will be a crea-

ture clothed in defensive armor of crystal, with an ovoid helmet on the head, from beneath which protrude the secondary antennæ, which in this family are always the larger, and the chief organs of locomotion. On the back is a small shield-like plate from which are suspended the two plates enclosing the body. Under the scuta of the back the heart can be seen pulsating regularly, while just below it is the intestinal canal, usually green from the vegetable matter contained therein. The jaws are suspended from the upper part of the head and meet below, where their toothed, grinding edges are placed in opposition, so that all the food must necessarily pass between them to be comminuted. The existence of a median dorsal plate in Daphnia seems to have been overlooked, it will be readily found however in this species (*D. vetula*) by placing a specimen on a slide and allowing it to dry and then tilting it up.

The genus Daphnia is quite well represented in our waters, both in variety of species and abundance of specimens. The section of the genus separated by Dana and called *Ceriodaphnia* includes those members which have a cellularly reticulated shell, but this character does not seem constant in the closely allied smaller forms which it evidently ought to include, if indeed the same species may not embrace forms with both reticulate and non-reticulate shells.

One of the most interesting of all Daphnia-like species is *Sida*, Plate III. A species of *Sida* and also a new species of the allied genus *Daphnella* occurs in Minnesota waters. The body of Sida is highly transparent, rendering the study of the inner parts less difficult than in most of these animals. The movement of blood corpuscles in the head and the currents caused by the branchial feet (indicated by arrows in the drawing) can be readily traced.

The curious *Polyphemus* also is represented, an animal in which the body is much curved upon itself, and the last joint of the abdomen is greatly elongated and bears two long flagella. The single staring eye, occupying the whole of the head, is the most conspicuous organ, while the apparently undeveloped branchial feet at first suggest the young of some other species.

But the most curious of all these minute, shelled forms, is the single species of *Bosmina* (Plate IV), which constitutes the family Bosminidæ of Dana. The idea at once suggested is a strange burlesque on the elephant, though the animal is not by any means of elephantine proportions, being not two hundredths of an inch

in length. The superior antennæ, usually very small or nearly obsolete in the Daphnoidæ, are the longer, but they agree with those of other members of the tribe in having little motion or play. These many-jointed appendages constitute the trunk of our elephant, lying as they do in so close juxtaposition as to seem a single organ. The shell of Brosmina is tuberculate and partly, at least, reticulated with hexagonal cells.

A group of smaller animals than any of the above is the old family *Lynceidæ* which is now included in the Daphnidæ. Many genera have been formed, but only one or two are founded on reliable generic characters. *Eurycercus* contains an animal nearly as large as Daphnia, but the remaining animals are small and they all agree in moving by a steady progressive motion rather than by successive bounds, which peculiarity is due to the shortness of the antennæ. The head is sharper in front and a little black spot beneath the eye, which is common to all Daphnidæ becomes in *Lynceus* and its allies as conspicuous as the eye itself. This spot is of unknown use but seems connected with the base of the antennæ.

There are representatives of two genera of the family *Cypridæ* to be found in every pool. These animals are enclosed in a shell which covers not only the body but the head also, so that the animal can withdraw entirely from view and close his shell about him like the mussel, which the shell much resembles in shape. The *Cypris* scurries about with an uncertain running motion, reminding one of the haste of an excited man,while the *Candona* loves the bottom. The inability to swim freely is due in Candona to the absence of the many setæ on the antennæ (the principal motary organs), which broaden these paddles in Cypris. In this sketch only a very few forms have been glanced at, and the legion *Phyllopoda* containing *Branchipus* and the "brine shrimp," has not been noticed, but objects enough to employ many a leisure day have been seen, any one of which might well repay weeks of study.

DESCRIPTION OF PLATES.[1]

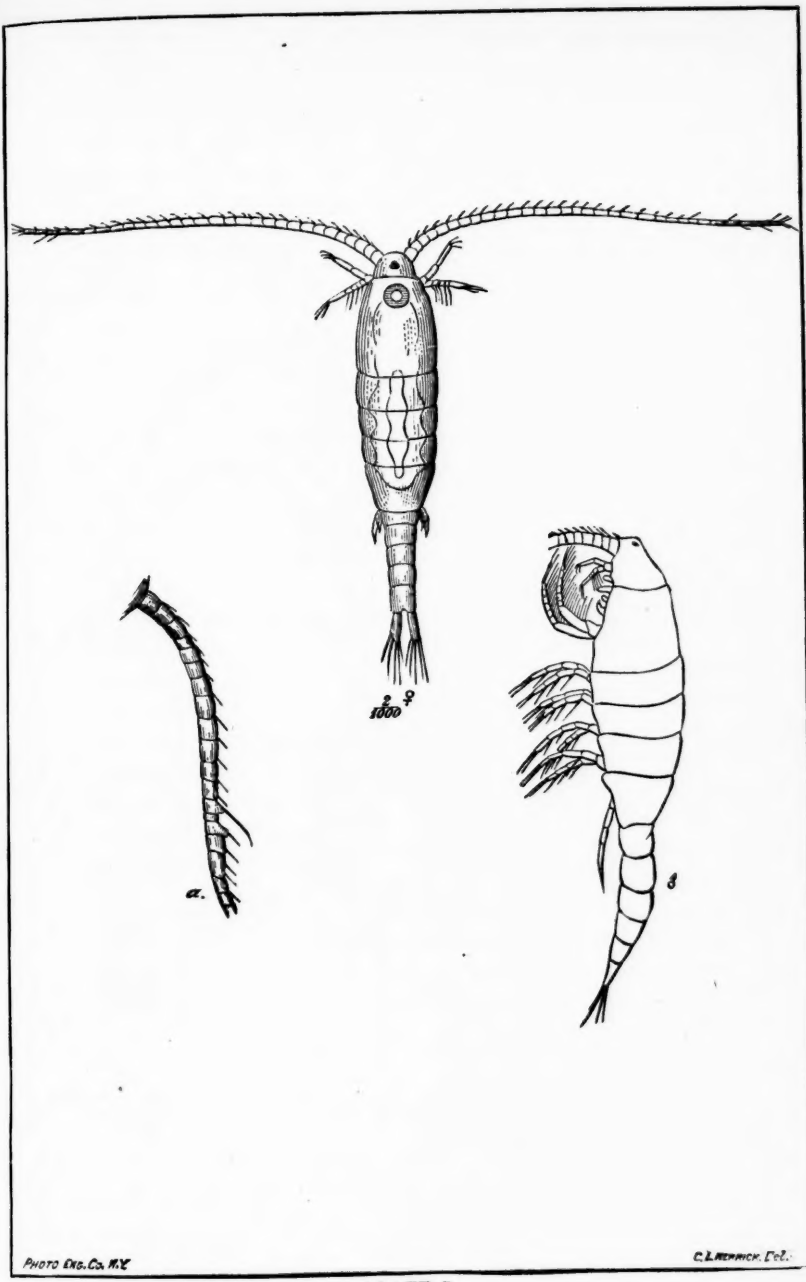
PLATE I.—*Diaptomus longicornis* Herrick, back view of female and side view of male; *a*, basal portion of male antennæ showing enlarged segments preceding geniculating joint.

PLATE II.—*Cyclops* sp. ? *a*, last pair of feet; 1, 2, 3, 4, 5, feet of *Cyclops quadricornis*; 6, inferior antennæ.

PLATE III.—*Sida crystallina* Straus. *a*, *b*, *c*, feet of first, second and last pairs; *d*, jaw: *e*, extremity of abdomen; *f*, superior antennæ.

PLATE IV.—1, *Bosmina longirostris*; *a*, portion of shell with superior antennæ; *b*, anterior antenna; 2, *Lynceus* sp. ?

[1] Used through the kindness of Prof. N. H. Winchell, Director of Minnesota Geological Survey.



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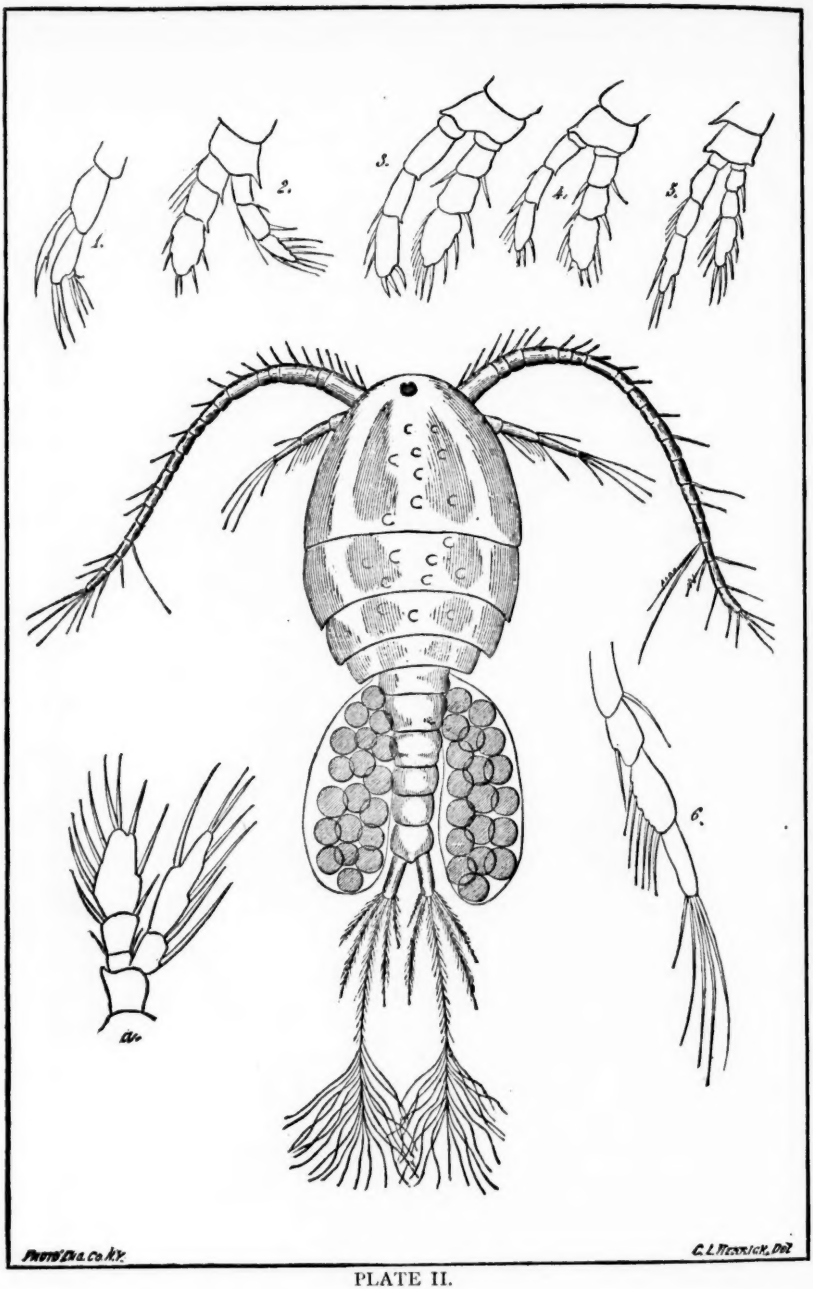

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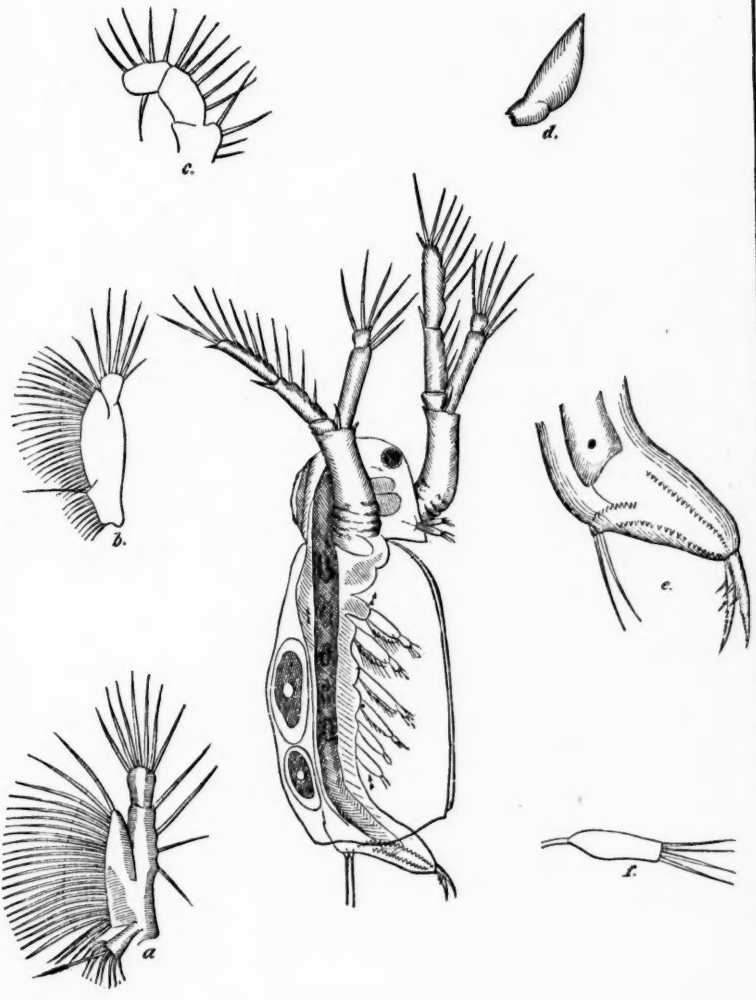
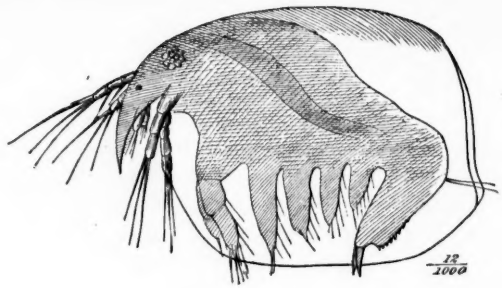
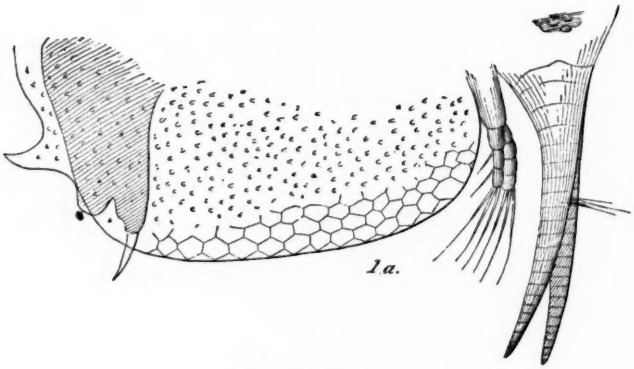


PLATE III.





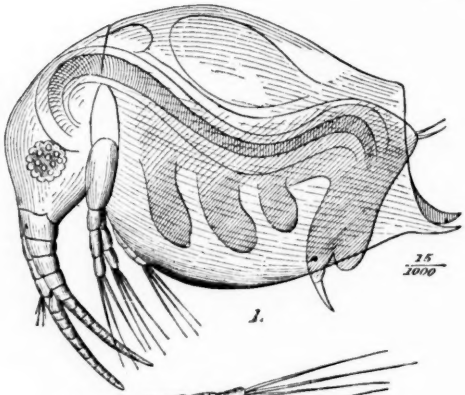


PHOTO ENG. CO. N.Y.

C.L. HERRICK DEL.

PLATE IV.

NOTES ON THE THRUSHES OF WASHINGTON TERRITORY.

BY S. K. LUM.

ALTHOUGH the number of species and varieties of the Turdidæ of the north-west coast is few, yet the number of individuals is great. The genus Turdus is here well represented by four species and varieties, viz: *T. migratorius*, *T. nævius*, *T. pallasi* var. *nanus* and *T. swainsoni* var. *ustulatus*. These, with Townsend's flycatching thrush (*Myiadestes townsendi*), comprise the list that I have observed in Western Washington Territory during a residence of twenty-five years, never having met with even a straggler of the genera Mimus or Harporhynchus. I am aware that the cat-bird (*M. carolinensis*) has been accredited a place in our avifauna (See Coues' Key to N. A. Birds, and Birds of the Colorado valley). Cooper speaks of it as found in the Cœur d'Alene mountains, and others as observed in Eastern Washington.

I have traveled extensively in Eastern Oregon and Washington without having met with a single specimen of this bird. There is a bird here, the towhee bunting (*Pipilo erythrophthalmus* var. *oregonus*) that utters a cry similar to that of the cat-bird, and, from the sound, might easily be mistaken for the latter bird. If found in Western Washington at all, it is as the veriest straggler, or I should certainly ere this have recognized my old acquaintance.

Townsend's flycatching thrush arrives here in March and remains until June. Their general appearance and habits are more those of a flycatcher than of a thrush. They may be seen perched upon the dry limb of a tree like the flycatchers, watching for insects, making sallies out after them and then returning to the perch.

During these times they now and then utter a loud, clear note, resembling the word "brevier," the accent on the last syllable. I have never heard the song spoken of by others, and so far as I know, they do not breed in this section. I have seen the young birds in their spotted plumage in the Sierra Nevada mountains of California.

The robin is extremely abundant, a few remaining during the winter, the majority passing further south; they breed here in great numbers, the nest being not unlike that of their eastern relatives.

The varied thrush will bear a more extended notice. Like his near relative, the robin, he is migratory, having a more northerly range. In numbers they nearly equal the robin. By the first of May they have all left for their northern homes to engage, as we are told, in the great work of reproduction—the shores of Alaska and the valley of the Yukon river furnishing them all that is necessary. About the first of October, when the first frosts have crimsoned the leaves of the vine maple, and the detached leaves of the large maple are slowly settling with their zig-zag motion to the earth, the ground already covered by the yellow forms, then may be heard the exquisitely sweet and musical notes of the varied thrush—not in a variety and succession of notes, but in one prolonged strain of a few seconds in a minor key; this is repeated at short intervals. Frequently there are several birds in company, varying in the pitch, thus giving a concert of voices succeeding each other, so tender, so plaintive, that the rude woodsman pauses to listen to the charming melody and asks, what bird is that?

The song of this bird, spoken of by Drs. Cooper and Suckley, I have never heard. This may be accounted for by the fact that I have never known them to remain here during the summer, which is their breeding time, and at other times than this they seldom utter these notes or I should have have observed it. They spend most of their time on the ground scratching for insects, and when flushed alight on the lower limbs, uttering a sharp "chuck!" "chuck!" then ascending higher and higher until out of danger. They are more vigilant than the robin and more disposed to scratch and turn over leaves after the manner of the "chewink."

Last winter I caught one alive and placed it in a cage; in a few hours it became reconciled to me, and took food from my hands. It would cram itself with rotten apples and bits of fresh meat until it could hold no more, and then look at me as much as to say, "I am sorry I can accept your generosity no more." In the course of a few days I secured another, which I placed in the cage with the first.

I soon discovered that the first one, so far from being pleased with his company, was quite the reverse, for the second being the older and stronger bird, pounced upon him in the most determined manner to kill him. I separated them, but no sooner was

my back turned than he renewed the attack, and would have killed him in a short time. I then removed the second one and introduced him in a cage with a sly, thieving, quarrelsome Steller's jay (*Cyanurus stellerii*). Now let the oppressor be oppressed; we will see the result. Thrush number two recognized an old acquaintance, and with that deference which consciousness of another's superiority inspires, quietly laid aside all hostilities; the two lived together peaceably, so far as I could discover, the jay being the more magnanimous of the two.

Three of our thrushes are found here during the entire winter, in greater or less numbers, viz: the two already treated of and a third, the dwarf or hermit thrush (*T. pallasi* var. *nanus*). Although most of the latter thrush pass further south, a few remain all winter. I have myself observed them in considerable numbers in the coast region north of San Francisco, Cal., in January. Their habits are shy and retiring, being found oftenest on the ground among the thick bushes.

In March and April they pass here on their way to their breeding grounds further north. I have never seen a solitary bird here during the summer. About the last of September they make their appearance from the north. Judging from the accounts of authors, of the powers of song of the near allied eastern hermit, we would suppose *T. nanus* to be possessed of musical powers of a high order. Perhaps this might be so could we observe him in his chosen breeding grounds accompanied by his mate and tender nestlings. However this may be, with us he is entirely silent, so far as I can say. If his presence is detected it must be from sight alone.

But if *nævius* and *nanus* withhold from us their song and desert us for more congenial northern homes, their place is well filled by another member of the family (*T. swainsoni* var. *ustulatus*). About the first of May, when the thick tangled, deciduous undergrowth of the tall sombre fir forests is decked in green, their blossoms on every hand exhaling perfume, will be heard the signal note of this bird announcing his presence among us. The lover of bird music now knows that the time for his enjoyment is at hand. The first note, loud and clear, is only a foretaste of what is to follow. The male has arrived first and is taking a survey of his old familiar haunts to see that all is right and the way clear before his mate joins him. For several days after his arri-

val no song is heard, then a low succession of notes comes from the thicket copse, as if he were trying his organs and training them for the grand concert to come. As time passes, these notes increase in strength, and by the first of June, when his mate has joined him and the site for their summer's nest is chosen, he seems enraptured by his own powers, as with quivering wings he pours forth a volume of song that seems to vibrate the green leaves of his surroundings.

You may hear him, but will seldom see him, so shy is he. Once, when this thrush was so absorbed in his own performance that he scarce seemed to notice me, I succeeded in getting directly under him. He sat on a limb about ten feet above me; first stretching himself up, he would utter a loud note similar to the last syllable of the bob-white quail, the "white" ending with the rising inflection; this was the prelude; then would follow a succession of notes impossible to describe, and which I can only compare to the vibrations of a wire or bell when struck, the undulations of sound gradually decreasing in volume and rapidity to the end. It seemed coming from a direction I could not determine, and as if broken in a thousand fragments on the surrounding shrubbery.

During the month of June the nest is constructed. It is oftenest found in low grounds, where the water stands during the winter, but at this season is dried up. Sometimes it is placed on the horizontal branch of a fallen tree, at other times in a small bush, and generally from three to six feet from the ground. It is simple in construction, being composed almost entirely of moss, about three inches in its inner diameter by two inches in depth. The eggs, four or five in number, are $\frac{1}{16}$ of an inch in length by $\frac{11}{16}$ of an inch in breadth, with a pale blue ground spotted all over with light reddish-brown. This I suppose to be the main breeding grounds of this thrush; their nests are found everywhere in the thickets of the lowlands, while during the early morning and the evening, from the dense forest and the thickest copse, and every sequestered grove, come the strains of this prince of the birds of song; who, as if loth to desist, often prolongs his song until after sunset, when the shades of night have thrown a weird gloom over the depths of the forest.

THE LEATHER TURTLE.

BY JOHN FORD.

IN all the realm of nature few avenues are more attractive to the student than those which lead into the ocean, for though trodden from time immemorial, a peculiar glamor still haunts the almost impenetrable veil beyond which they end. Such a mysterious charm might of itself awaken an interest in the minds of men. But an incentive far more potent is found in the hope that behind this shadowy veil thousands of unknown forms of life are hidden, awaiting only the coming of some modern Aladdin at whose touch the doors of their habitations shall fly open and their strange and weird beauty be revealed.

That myriads of living creatures do people these wondrous depths is shown by the appearance, at intervals, of the more venturesome ones on our shores, inciting the careful observer to renewed efforts in the study of their forms, their habits, and their previous surroundings.

It is true that many problems regarding the latter must of necessity remain unsolved, yet much may be studied and much be learned by patient and persistent endeavor.

With this purpose in view I have collected a few facts respecting the recent advent of specimens of *Sphargis coriacea*, a species as little known to the general reader, perhaps, as any other of like dimensions found in the Atlantic. The animal has indeed been referred to by a number of writers, but in all probability their stock of information has, in most cases, been derived from hearsay rather than from direct examination of specimens. In an English work on general zoölogy, published by Dr. George Shaw in 1802, we are informed that the coriaceous tortoise is a native of the Mediterranean, albeit specimens had been taken now and then on the coast of England; and of one captured in 1729 near the river Loire, in France, the author remarks: "It is said to have uttered a hideous noise when taken; its mouth at the same time foaming with rage and exhaling a noisome vapor." He also adds, that according to Lacepede, "the Coriaceus tortoise is one of those with which the Greeks were well acquainted, and he supposes it to have been the species particularly used in the construction of the ancient lyre or harp, which was at first

composed by attaching strings to the shell of some marine tortoise."

The first specimen seen in this latitude, of which I can find any record, was captured in Chesapeake bay in the year 1840. This was measured by Dr. E. Hallowell, an eminent herpetologist, but his figures differ so slightly from others made more recently, it is unnecessary to repeat them. As, however, the description given in the second volume of North American Herpetology, a work published in 1842 by Dr. John Edwards Holbrook, was the result of an examination of this specimen, it is reproduced here in a somewhat condensed form, as follows:

"*Characters.*—Head large, jaws strong, superior having three deep triangular notches, inferior hooked; body covered with a coriaceous skin, tuberculated in the young, smooth in adult animals; extremities without nails.

"*Description.*—The carapace is sub-cordiform, largest before and deeply concave on the neck; it is narrow and pointed behind and above, and is marked with seven longitudinal carinæ, one of which runs along the entire vertebral line. On either side of this are three others, the external ones following the margin of the carapace from its anterior to its posterior extremity, where they meet in a point above the tail. The nostrils are anterior and near together. The neck is short, very thick and covered with a coriaceous skin. The anterior extremities are twice the length of the posterior ones. The tail is short and extends but little beyond the carapace. The whole superior surface of the animal is of a dark brown color with exception of the carinæ, which are tinged in different places with obscure dirty white."

A very fair portrait of *Sphargis coriacea* accompanies this description.

So far as I can learn no later evidence has been given of the presence of Sphargis on our shores prior to the summer of 1878, when four specimens were stranded upon the coast of New Jersey. Of these two were doubtless first discovered near Atlantic City by the writer and a friend, Mr. Chas. Morris, one of them, in fact, being observed for some time before it was borne by the waves to our feet. They were both dead, though otherwise in good condition.

The two others mentioned were landed at a later period near Beach Haven, Ocean county. In reference to them Isaac Hall, an old sea captain, remarked, that "he had seen turtles of all

kinds, but these were the largest he had met in any quarter of the globe."[1]

In the early part of the present year (1879) a fine specimen was shot off the coast near Wilmington, North Carolina, by Capt. Chadwick of that city; and still later another was caught at Gloucester, Virginia, by Mr. W. H. Ash, the wharf agent at the point, who struck it a powerful blow on the head with an oar, stunning it and making it an easy prey.

The former of these, which is said to have measured seven feet in length by three and a half feet in width, appears to have puzzled the good people thereabouts in regard to its true character, some calling it a turtle and others a devil-fish, while the captain held to the opinion that it was Old Nick himself. Unfortunately, however, for their future prospects, it proved to belong to the species under consideration; "more's the pity," perhaps.

The specimen taken at Gloucester Point, though smaller than the last mentioned, was none the less surprising to its captor and others who saw it, many of them being of the same opinion regarding the fate of "Old Nick" as their more southern brother.

With the exception of one taken alive in Delaware bay, June 1, 1879, the above half dozen specimens comprise, so far as any records appear, the whole number found on our coast since 1840, a fact which seems to corroborate the opinion of Dr. Holbrook, who assumed that they were quite rare in American waters. Nevertheless, Dr. Leidy, Mr. John A. Ryder and others, who have given the subject much attention, believe them to be more plentiful than has been supposed.[2]

As a proof at least of their wide distribution, it may be mentioned that in addition to those referred to by Dr. Gray, two specimens were cast up on the coast of France in 1872; one of

[1] An account of this turtle was given by Dr. D. H. Storer in his Report on the Reptiles of Massachusetts, 1839. The specimen there described was figured on an excellent plate by Dr. Jeffreys Wyman; it "was taken asleep on the surface of the water in Massachusetts bay, in the year 1824." A specimen weighing about 1000 lbs. was captured in Narragansett bay in the summer of 1878, and was presented to the Museum of the Brown University, Providence, R. I., where it was stuffed by the Curator, Prof. J. W. P. Jenks.—*Editor.*

[2] Since the above was written I have learned from Mr. John H. Dusenbury, a Philadelphia dealer, that he received a dead specimen of *Sphargis coriacea* from Delaware bay, in 1872, which weighed 916 pounds; the skeleton of which was afterwards placed in the collection belonging to Mr. O'Brien, the showman.

which was obtained by Prof. Paul Gervais, and the skeleton preserved by him for the Museum d'Histoire Naturelle at Paris.

The great age of the genus in Europe is also shown by the discovery of *Sphargis pseudostracion* Gervais, in the Miocene, near Montpelier. *Protostega gigas* Cope, from the Cretaceous of Kansas is closely allied to *Sphargis coriacea*, though a much larger species, the length being 12.8 feet and the width from tip to tip of the anterior flippers, 11.3 feet.

Two other species, *P. neptunia* and *P. tuberosa*, the former from the Cretaceous of New Jersey and the latter from the same formation in Mississippi, have also been described by Prof. Cope, which seems to prove that the genus Protostega was quite as prevalent in Cretaceous seas as is Sphargis in those of the present.

Unfortunately the specimen captured in Delaware bay and brought to Philadelphia, lived but a short time afterward; its death having been hastened by an injury received from a boat hook or other weapon during the struggle to capture it.

The chance of seeing such a huge denizen of the ocean was a rare one, however, and very many citizens, including some eminent naturalists, took advantage of it. As a precautionary measure, the animal was kept upon its back; nevertheless, the muscular power displayed by the creature when trying to regain its normal position was something remarkable. Especially was this the case just previous to dying, when, according to its owner's statement, the united efforts of four men were required to keep it in place.

During a quiet interval the subjoined measurements were taken by the writer, kindly assisted by that careful naturalist, Mr. John A. Ryder:

	Feet.	Inches.
Entire length of animal	6	7
Length of carapace	5	0
Greatest width of same	3	4
From tip to tip of anterior flippers	8	8
Greatest width of anterior flippers	1	0
From point of beak to edge of carapace	1	3
Diameter of neck	1	0
Elevation	1	4
Width of breast	3	0
Length of tail	0	6

As a subsequent measurement suggested no alteration of the figures given they may therefore be accepted as approximately

correct.. The weight of the animal, taken soon after its death, was 765 pounds; as much, perhaps, as the half dozen specimens I have alluded to would average.

It follows, therefore, that these were but a little more than half grown, or that 1200 pounds, the estimated weight of an adult, as given by Dr. Holbrook, is much too large. A further examination of the specimen, which was fortunately secured by Prof. Cope, will, doubtless, decide the matter. In the meantime, a few of the more prominent characters pertaining to the animal may be profitably referred to. For instance, the mode of respiration in Sphargis is peculiarly marked. This is apparently effected by inflating the throat with air until it is much enlarged, and then by closing the nostrils and contracting the throat, suddenly forcing the air back into the lungs. That this pumping process is common to all the Testudinata is known, but that it effects respiration is denied by Drs. Mitchell and Morehouse, who ascribe this function to the axillary and inguinal muscles.

A much wider difference is found in the skeleton. Thus, in Sphargis the vertebral column is entirely independent of the carapace, while in other genera it is co-ossified. It differs also in having the carapace disconnected with all the other parts of the skeleton. Another peculiarity consists in the carapace being composed of a vast number of small bony irregular tesseræ joined by minute suture. The plastron is also more rudimentary than that of other turtles, being represented by a mere oblong ring of bones. Of course these embrace the more prominent features. It is not improbable, however, that a careful study of the animal will develop other points of equal interest, in which event the cause of science will be profited.

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WERE THEY MOUND-BUILDERS?

BY S. L. FREY.

THE question as to whether the mound-builders extended their occupation as far east as Eastern New York is an open one; and while some relics recently discovered have led some writers[1] to the conclusion that they had, I think that we need much stronger proof before we are warranted in drawing this inference.

It is but fair to conclude, however, judging from analogy, that

[1] Wm. L. Stone, *Magazine of American History*, September, 1878; Prof. Geo. W. Perkins, Portland Meeting of the American Association; Smithsonian Contributions, II, p. 58.

some people occupied this section of country before the advent of the Iroquois, for we cannot think that previously to that time, this fertile land, abounding in fish and game, was entirely without inhabitants. Who these tribes were, Hurons, Shawanoes, or some more advanced people, is but a matter of conjecture. It is an interesting subject for investigation, and it may be the good fortune of some one yet to discover relics that will lead to an elucidation of the mystery.

In this paper I wish to call attention to and describe some ancient graves, and their contained relics, which I have recently opened and examined, leaving it for others to conclude from the premises which I shall furnish, whether these were simply Indian graves of an old date or those of another people.

I have known of the place, examined for many years, and had, with others, previously done some superficial digging, finding at one time, in a grave, thirty arrow-heads and a small copper awl. The latter, of which Fig. 1 is a drawing, might have been used for piercing holes in buckskin garments, but as implements for

FIG. 1.—Full size.

this purpose were usually made of bone with the point rounded and sharpened in a similar manner, and as these were obtained with comparative ease and were equally serviceable for sewing purposes, I think that possibly this copper implement had a different, or at any rate an additional use. According to many early writers the natives at the time of the discovery, were found in possession of ornaments, necklaces, &c., of pearls, the perforating of which was done with a heated copper spindle. The square shape of this implement indicates that it has been set in a handle, and the point being very smooth, shows use of some kind. That it was intended for a drill of this description seems not improbable, when viewed in connection with certain shell relics subsequently found, and which are described in this article.

Aside from the above, as far as I have been able to learn, little had been found by others digging at this place. It is known as an "Indian burying-ground," and was originally an extensive knoll of sand and gravel with an upper stratum of loamy soil about four feet in thickness, mixed with angular fragments of sand rock. It has a southern exposure, and is abutted on the north by a precipitous rocky hillside. Unfortunately, however, the most of this old graveyard was removed years ago to make an

embankment for a railroad, and tradition says that many skeletons and relics were unearthed at this time, the bones being buried under the roadway, and that the relics, through the customary ignorance of the workmen, were destroyed and lost.

In Fig. 2 I have given a section of the place which shows the original form and what remains of the graveyard sufficiently well;

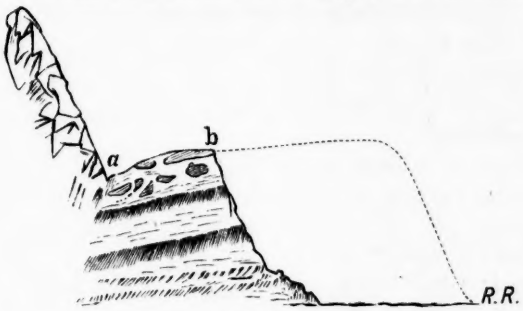

FIG. 2.

the point between *a* and *b* is where the graves which I opened were found; its conformation and the character of the soil suggested that it might have been somewhat artificially altered.

So much digging had been done previously to little purpose, that I had little faith that any graves remained undisturbed, but a friend of mine accidentally hearing that a curious pipe had recently been found, we visited the place one afternoon in November, too late, however, to do more than a little hasty and superficial digging. Examinations of places of this kind, containing graves of an ancient date, should of course be made with care, else will most of the bones and interesting relics be destroyed, or at any rate no satisfactory conclusion can be arrived at in regard to the manner of burial, probable age, &c.

Although our digging at this time was hasty, and done a little recklessly, I was fortunate in finding one grave, from which we obtained several relics of interest; the most curious being a tube, the shape and general appearance of which is represented by Fig. 3. This tube case, being covered with a dark earthy deposit, we were led at first to think was made of clay, but upon closer examination with a powerful magnifier, I am inclined to think that it is of stone, steatite perhaps. Under the glass there is none of that appearance of pounded shell or stone so generally observed in all early fictile fabrics. The rings and marks made by the boring tool are also plainly seen in all of them.

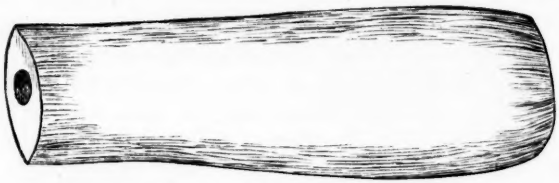

FIG. 3.—One-half natural size.

This tube is four and a quarter inches long, the perforation has at one end a diameter of one-quarter of an inch, gradually enlarging until it reaches at the other end a diameter of three-quarters of an inch.

Besides the tube, we found at this time a sea shell, somewhat modified for a drinking vessel, its longest diameter being four inches, a beaver's tooth, several bone awls, three arrowheads, a number of flint flakes, pieces of a tortoise shell, some fragments of deer horn implements, the bone gouge, Fig. 4, and a large wing bone of a bird.

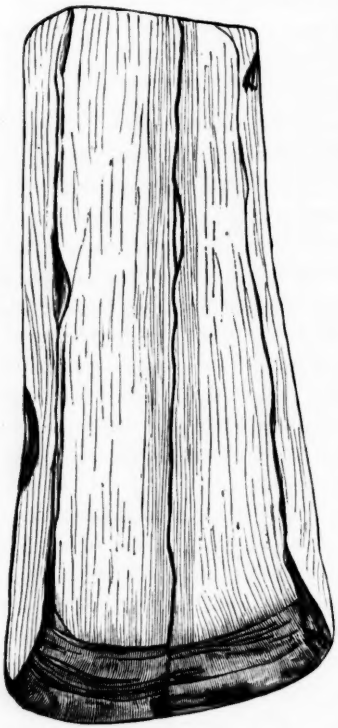

FIG. 4.—Bone Gouge, full size.

A few days after this I again visited the place with a couple of workmen, and prepared to give it a pretty thorough examination. I commenced digging at the grave we had previously found, and cleared off a space several feet wide immediately below it, so as to be able to determine the manner of burial. I found that there had been two bodies buried in this grave, side by side, in a sitting posture, facing the east, a pit having been dug about three feet in depth and lined with flat stones previously to the interment. This manner of lining the grave I have not before seen, but all the graves examined were of this kind. Large boulders and angular pieces

of sand rock had, however, in some instances been rolled into or on top of the grave, a protection, perhaps, against wild beasts. The bones were very much decayed, so that it was impossible to save even the skulls.

In addition to the relics previously described I found another tube; it appears to be of the same material as the one already figured, but differs from it in shape and length. It is eight and one-half inches long and one inch in diameter, having a bore of five-eighths of an inch at one end and two-eighths of an inch at the other. It is smoothly made but has no polish at present, being covered with an earthy coat, and in patches with a thick concrete of lime and sand. With this tube were found lying side by side, three hornstone implements; they are respectively five and one-half, six and one-quarter and six and one-half inches long, and about one-quarter of an inch thick in the center, beautifully chipped and of perfect proportions, the material approaching nearer to flint than any other specimens found here, the conchoidal fracture being even and perfect, and the edges semi-transparent.

FIG. 5.—Hornstone Implement, full size.

The mineral seems to have been selected out of regard to its beauty, the points of all of them being lighter colored than the rest of the implement. In the largest one, Fig. 5, appears a small nucleus, around which

the mineral formed in concentric circles, shading off from the center to the circumference, and very much resembling some of the hornstone disks made from the material at Flint Ridge, in Ohio. The upper side of these implements was partially covered with the same kind of concrete which adhered to the tube. I have endeavored to show this in the engraving.

Proceeding into the side hill about six feet I came to another grave, the first indication of which was the red color of the surrounding earth; the body was at the same depth as the last, and the grave lined with stones in a like manner. Although the bones were too badly decayed to judge with certainty, I believe this to have been an extended burial, as the skull seemed to be in place, and on the same level as the pelvic and leg bones. The body had been buried with the head toward the west. The first object found was a piece of "slaty graphite" about five inches long, four inches broad and two inches thick, the surfaces of which are deeply grooved and furrowed, apparently with sharp flint-flakes or other stone tools. For what purpose these irregular grooves had been made it is difficult to say; they resemble those in the so-called sharpening stones, but as this material is soft it could not have been used for such a purpose. I think it probable they were made to obtain the powdered black lead for purposes of decoration, or in the manufacture of a pigment of some kind. This piece of ore and the ground for some distance around was covered with a red earthy deposit several inches in thickness, which had colored the earth and stones, as I first observed, as well as the bones and contained relics. In none of the other graves was so much of this red substance found, and none at all in some of them. It is without doubt red hematite, placed in the grave for some purpose.

Imbedded in this red ore I found two tubes, similar to those before described but longer, the perforation large at one end and small at the other, and the striæ and drill marks, showing plainly on the inside, indicate that the material is stone; they were nearly ten inches long and an inch in diameter. If the uses of these tubes were known, we might be able to conjecture why two so similar should have been buried in one grave.

Near the tubes, and also imbedded in the hematite, I found what had apparently been a necklace or head-dress, composed of copper and shell beads; the former were badly oxydized, and had

been made of thin sheets of copper rolled into tubes. That they had been worn around the head or neck was evident, for one side of the skull and the lower jaw-bone were stained a dark copper color. Many of the shell beads were also stained by the copper; those so colored retaining their original polish, being hard and glassy, like ivory, while those not so stained were brittle, many of them falling into a white laminated powder. The shell beads were fifty-nine in number, besides those that were too badly decayed to handle, and were from half an inch to one and three-quarter inches in length, and averaged about half an inch in diameter. They were of that kind so fully described by the early writers, made from the columellæ of large sea shells and rubbed and ground smooth with great labor, and afterwards drilled through their longest diameter with greater labor still. They were known by the names of "roanoke," "peak" and "wampum," and were worn by the southern Indians as nose and ear jewels, necklaces, etc. The drilling of these hard shells when iron tools were unknown, must have required patience and industry, and we may well look at them with wonder, and as evidences of the possession of these virtues by their unknown makers. The drilling had been done in most cases from each end, the holes meeting in the center. In some of the shorter ones, however, the perforations were made from one end, being of uniform size throughout. The spiral grooves where the whorls of the shell wound round the hard central column, can be seen in all of them. In addition to the beads and probably forming a central pendant to the necklace, there was found an elk's tooth. It is stained a beautiful copper color and highly polished.

On the same level as the last grave, and about six feet to the west of it, I came to another, similar in all respects, lined with flat stones. The body was apparently extended, with the head toward the south; the bones were nearly all decomposed. The relics found were the remains of a necklace of shell beads, little copper tubes and small sea shells about half an inch long, with a hole drilled in the large end. The only way that these latter can be strung is with a "waxed end" tipped with a bristle, such as shoemakers use. This follows the whorls of the shell, and it is the only way, apparently, in which they can be utilized as beads. Their makers may have had some other way, but I have not been able to discover it.

In addition to what has already been described, the workmen found two graves further to the east and lower down on the hillside. The first contained merely a skull and a few large leg bones, the interment being unlike the others. The skull rested face down on the other bones, the ends of which had apparently been gnawed by some carnivorous animal, the tooth marks being plainly visible. From these circumstances I think the bones may have been collected on the surface and buried as I found them. The skull, although too much decayed to be taken out except in small pieces, was fully twice as thick as the others, with the ridges largely developed. The marked anatomical differences and the burial, so unlike the others, there being no relics found, would indicate that this man belonged to another people. At any rate little respect seem to have been paid to his remains.

The second grave contained nothing but the moldering skeleton of an individual who had been buried facing the west.

A few days after this I made another examination of this place, accompanied by a friend. At this time we found but one grave. It was a short distance west of the others, and similar to those already described, with the same lining of flat stones. The bones were at a depth of four feet, that being the deepest grave of any found. It was apparently an extended burial, the skull rested on a stone a little above the level of the body and faced the west. In this grave I found two shell beads and one hundred and eighty-nine arrow-heads; the latter were all of one type, leaf-shaped with truncated bases. They vary from one inch to two inches in length; the material is chert or hornstone; and they are sharp and chisel-like at the base, with serrated edges and sharp points. These one hundred and eighty-nine arrow-points to a savage people meant far more than we are qualified to appreciate. It was so much wealth, so much food-producing material rendered unavailable. What a vivid picture this old grave and the decaying bones of its occupant give us of the poverty of these stone-age people.

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RECENT LITERATURE.

GEOLOGICAL SURVEY OF INDIANA.[1]—These reports embrace descriptions of the geology of Wayne, Crawford and Harrison

[1] *Eighth, Ninth and Tenth Annual Reports of the Geological Survey of Indiana, made during the years 1876, '77, '78.* By E. T. COX, State Geologist, assisted by Prof. JOHN COLLETT and Dr. G. M. LEVETTE. Indianapolis, 1879. 8vo, pp. 541, with maps.

counties, with a general survey of the geology of the State, and special reports on the economic geology. Considerable space is given to palæontology, Mr. S. A. Miller contributing a catalogue of fossils found in the Hudson river, Utica slate and Trenton groups, as exposed in the south-east part of Indiana, south-west part of Ohio and the northern part of Kentucky; while Prof. J. S. Newberry supplies a list of certain sub-carboniferous fishes, with descriptions of several new species; among them teeth much like those of the living rays, especially Myliobatis, the writer expressing "little doubt that they represent the oldest and most gigantic members yet known of the ray family." A good deal of space is devoted to the archæology of the State, but the chief interest of the report lies in the full account of the famous Wyandotte cave, illustrated by a large map. The geology and topography of the cavern, with adjoining caves, is given in detail, and for the first time we have mapped out one of the largest and most beautiful grottoes in the world. On one of the maps illustrating the reports is laid down the position of the numerous caves occurring in the subcarboniferous limestone called the St. Louis or cavernous limestone. Appended are Prof. Cope's observations on Wyandotte cave and its fauna, revised for this report.

HYATT'S COMMON HYDROIDS, CORALS AND ECHINODERMS.[1]—This is the fifth brochure of the series of Guides for teachers of science in schools. It is intended to supply such information as they need in teaching and are not likely to get from other sources. The style is clear and attractive, and the illustrations fresh and good enough for the purpose, and some of them drawn by Mr. Van Vleck for the book. In this connection we may draw attention to what was done the past winter by the Boston Society of Natural History, through its custodian, Prof. Hyatt. It was found in October that the assistance of the society was earnestly desired by those interested in the proper introduction of the study of nature in our public schools and in the cultivation of a faculty for observation among the school children, and it was resolved to institute appropriate courses of lessons for the teachers, if the means of paying expenses could be raised by donations. The necessary funds were secured by two ladies who are members of the society, which may congratulate itself upon such evidence of the activity and usefulness of this new class of its members. Fortunately for their success, these ladies met with appreciation from Mrs. Augustus Hemenway, without whose assurances of support and interest the society would not have dared to begin these courses at an estimated cost of three thousand dollars. Many of the schools contributed, in varying sums, to the amount of seven hundred and twenty-six dollars. The

[1] *Boston Society of Natural History. Guides for Science Teaching. No.* V, *Common Hydroids, Corals and Echinoderms.* By ALPHEUS HYATT. Boston, Ginn & Heath, 1879. 12mo, pp. 32.

rest of the subscription was made up by ladies, many of whom have been long known as patrons of similar undertakings or interested in public education.

Notwithstanding this generous assistance, it would not have been possible to carry on the several courses without the friendly aid of other institutions and individuals. The Institute of Technology very generously placed Huntington hall at the service of the society, upon the payment of a mere nominal sum for the heating and care of the same. The Museum of Comparative Zoölogy gave hundreds of duplicate specimens; and several assistants and students of the society and institute gave material assistance. The Parker House and Young's Hotel gave freely such parts of birds as were needed to illustrate one lecture. All the teachers attending these lectures have been furnished with sets of specimens, amounting sometimes to ten or more, which they have studied under the direction of the lecturer, and taken away with them to use subsequently in their own instruction. In this way about one hundred thousand specimens have been distributed, and it is known that they have already materially assisted many teachers. Since this sort of lecturing was first instituted in the fall of 1871, under the patronage of Mr. John Cummings, there have been studied and distributed to teachers of the public schools about seventy-five thousand specimens of minerals, rocks, plants and animals. The applications for tickets rose during these years from fifty-five to one hundred and sixty-six, and during the present course to six hundred and sixteen, with an average attendance of about five hundred.

RECENT BOOKS AND PAMPHLETS.—Oversigt öfer de af sven-ka Expeditionerna till Novaja Semlja och Jenissej 1875 och 1876 insamlade Hafs-Mollusker. Af Wilhelm Leche. 4to, pp. 86, pl. 2. (Extr. Kongl. Suenck. Veten-Akad. Handl., Bandet 16, No. 2.) Stockholm, 1878. From the author.

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The Medical and Surgical Reporter, Vol. XL, No. 26, June 28, 1879. Philadelphia, 1879.

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Proceedings of the Academy of Natural Sciences of Philadelphia, 1879, pp. 137–152. From the society.

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Description of fragmentary indications of a huge kind of Theriodont Reptile (Titanosuchus ferox Ow.) from Beaufort, West Gough Tract, Cape of Good Hope. By Prof. Owen, C.B., F.R.S., etc. 8vo, pp. 189–199, pl. 1. (Ext. Quar. Jour. Geol. Soc., 1879.) From the author.

On the Fossils called "Granicones;" being a contribution to the Histology of the Exo-skeleton in "Reptilia." By Prof. Owen, C.B., F.R.S., F.R.M.S. 8vo, pp. 233-236, pls. 2. (Extr. from Trans. Roy. Mic. Soc., Vol. I, 1878.) From the author.

Eighth, Ninth and Tenth Annual Reports of the Geological Survey of Indiana, made during the years 1876, '77, '78. By E. T. Cox, State Geologist, assisted by Prof. John Collett and Dr. G. M. Levette. 8vo, pp. 541, with four maps. Indianapolis, 1879. From the State geologist.

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Proceedings of the Royal Geographical Society and Monthly Record of Geography, Vol. I. 8vo, Nos. 5 and 6, May and June, 1879. London. From the society.

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A List of the Brazilian Echinoderms, with notes on their Distribution, etc. By Richard Rathbun, Assistant of the U. S. Fish Commission. (From the Trans. of the Connecticut Acad. of Arts and Sciences, Vol. V, 1878.) 8vo, pp. 19.

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GENERAL NOTES.

BOTANY.

PRECOCIOUS FLOWERING OF THE CITRUS POMONA.—On December 14, 1877, I sowed, at my place at Santa Fe lake, Florida, 289 seeds of the grape-fruit (*Citrus pomona*). This tree appears to be closely related to the shaddock (*C. decumana*), but the fruit is much smaller, being only a quarter to a third larger than a large-

sized orange; the bitter rind is smooth and of a dirty pale yellow. The seeds were slow in germinating, not appearing above ground for about eight weeks. When scarcely two inches high a blossom appeared at the top of one of the little seedlings. The flower, of fair size, was perfect in every respect, even to having the rich odor similar to that of the orange blossom, and was fully expanded on April 16, 1878, or when the little tree was only about two months old. I watched anxiously for the forming of the fruit, but this seems to have been too much to expect, for the flower fell away without exhibiting any evidence of having been fertilized. This progressive individual was, in other respects, not different from its fellow seedlings, nor did it seem to be injured by its premature efforts to produce its kind.

I have already sent the NATURALIST (see Vol. XI, p. 489, August, 1877) some notes on a similar precocity in the orange (*C. aurantium*), and now add an instance of this curious feature in another species of the same genus.—*Henry Gillman, Detroit, Michigan.*

BEES GATHERING HONEY FROM THE CATALPA.—At a recent meeting of the Philadelphia Academy of Natural Sciences I called attention to the fact that there existed large patches of nectariferous glands on the under side of the leaves, in the axils of the veins, of *Catalpa bignonoides.* Up to the present time the proof that the glands in question were nectariferous, rested only on the evidence of the taste of the secreted fluid and the presence of ants of both red and black species, apparently feasting upon the nectar. Since then I have found the common honey-bee gathering the nectar from the foliar glands with as much industry as from the flowers, the latter of which at the time the observation was made having fallen, so that there was positive evidence that the glands alone attracted the bees. Furthermore, the bees were seen to introduce their tongues into the axils of the leaves where the secretion was present in a visible quantity on the gland, and lap it up as when getting the nectar from flowers. The bees engaged at this work carried no pollen at the time, and were apparently devoted to getting the honey only.

These observations place the question of the saccharine nature of the secretion beyond any doubt, and make it probable that the Catalpa is valuable as a honey plant, and deserves a place in lawns, parks and pleasure grounds, on account not only of its beauty, but also from its economic value to the bee culturist.—*John A. Ryder.*

THE FERTILIZATION OF THE WISTARIA.—In front of my study windows grows a beautiful American Wistaria; the great purple racemes hanging in the open window fill the room with their delicate perfume. During the day the blossoms are usually visited by two or three brilliant little humming-birds, and by many

flies and bees, all attracted by the color, fragrance and nectar of the flowers. I have been interested in noticing the manner in which the insects, particularly the large humble bees, aided in securing the cross-fertilization of the blossoms.

As is well known the Wistaria bears papilionaceous flowers, like the pea, bean, etc., the wings of which clasp the closely appressed and somewhat coherent petals forming the keel, the latter inclosing the stamens and pistils. In the newly expanded flower, which has not been visited by insects, the stamens and pistils cannot be seen without parting the petals forming the keel; we then find the stamens united throughout the greater portion of their length, and then, together with the pistil, bent upwards at nearly a right angle; the reason of this abrupt bend will be seen farther on.

When a bee alights on the blossom it clings to the petals forming the wings, and thrusts its proboscis upwards under the base of the banner where the nectar is secreted; in doing this the weight of the insect presses down the wings and keel of the blossom and forces upwards the stamens and pistils and presses their extremities with considerable force against the thorax and abdomen of the bee. In this manner the insect becomes dusted with pollen from many flowers, some of which cannot fail to find its way to the sticky stigma which is ripe to receive it. When the bee has secured the sweets that it loves, and departs, the petals usually resume their former position with the stamens and pistils concealed. It is interesting to watch the workings of this curious plan for securing cross-fertilization in the Wistaria, as this plant, from the structure of its blossoms, seems to offer great obstacles to its accomplishment.—*Israel C. Russell, Plainfield, N. J.*

HUMBLE BEES AND THE GERARDIA FLAVA.—Some years ago I sent a note to the NATURALIST stating how the humble bees perforated the corolla of *Gerardia pedicularia.* I have, within a few days, noticed that they act in the same way, to a less degree, with *Gerardia flava* when growing in quantity. I came upon an unusually fine lot of this in Providence on the 3d of August, a very hot day. The bees were numerous, and in many cases directed their flight at once to the holes made by previous visitors on the upper sides of the corollas, near the base. Some flowers, however, were approached in the usual way. It is said that this burglarious proceeding is only noticed in the case of such plants as bloom profusely. The consequence might be in time a perceptible diminution of individuals, when, owing to less competition, the insects would act in a legitimate way, that is, approaching by the open tube.—*W. W. Bailey, Providence, R. I.*

PRUNUS PUMILA.—Growing on the sand ridges by the shore of Lake Michigan, at Pine and Millers, Indiana, are very large plants of this species. Most authorities state that the stems are

from six inches to two feet high, and trailing, a description that accords very well with the character of the plant where I have seen it away from the shore of the lake. On receding from the lake the size diminishes, and one does not have to go far to find the typical form. But here, stems four or five feet long and half an inch or more in diameter, are common; some attain the length of seven feet. Two that were measured had a girth, near the ground, of four and a half inches and five and a quarter inches, respectively. This gives a diameter of 1.43 and 1.67 inches. The stems trail but little, several spreading from the same root, much as in the common juniper, but of a more erect habit. They are decumbent, ascending or sub-erect. The fruit, when ripe, is about the size and color of the Morello cherry, and but slightly ovoid in form. In remarkable contrast with this sand cherry is the necklace poplar (*Populus monilifera* Ait.), generally a good-sized tree, fruiting abundantly in the same situation at the height of from five to ten feet. The conditions that favor the growth of the cherry, dwarf the poplar, and the former has the advantage in the struggle for existence on the sand dunes of the lake shore.—*E. J. Hill, Englewood, Ill.*

Botanical News.—To the *New Italian Botanical Journal* for July, F. von Müller contributes an article on the systematic position of the genus Donatia. L. Mecchiati records certain experiments on the emission of carbonic acid from the roots of plants. ——Lübken and Warming's Danish *Journal of Popular Science*, third number, contains a well-illustrated article on Schwendener's lichen theory.——In Trimen's London *Journal of Botany* for July, A. W. Bennett concludes his Polygalæ Americanæ novæ vel parum cognitæ. The August number reports the publication of the second part of Hemsley's Diagnoses of new Mexican and Central American plants, dated July, 1879; about eighty new species are described.——Coulter's *Botanical Gazette* for August, among other notes, prints one on *Salix balsamifera*, by M. S. Bebb; while J. M. Coulter contributes notes on parallel chorisis in the petals of *Campanula media*; on a 4-merous *Lilium philadelphicum*, and on two-parted cotyledons in Eschscholtzia. ——In the *California Horticulturalist* G. Eisen tells how to treat living plants received by mail. He submerged the plants, moss and all in two pints of tepid water and one teaspoonful of pulverized camphor for one hour; then spreading a layer of wet moss on a newspaper he sprinkled the moss with two teaspoonfuls of pulverized camphor gum; on this he opened the geraniums evenly, covering them with wet moss, and on the top spread another sheet of paper. In this bed the plants should remain over night. The next morning the plants should be potted and kept out of direct sunlight for a few days. The plants should be watered very sparingly with camphor water.——The Tenth Annual Report of the Geological Survey of Indiana contains a cata-

logue and check list of the trees and woody shrubs of America, north of Mexico, by John W. Byrkit. It occupies fifteen pages of the report. Mrs. Haines also contributes a list of the ferns, mosses, hepaticæ and lichens of Wayne county, Indiana.—— *Grevillea* for March and June contains an article by Dr. M. C. Cooke, strongly opposing the "dual lichen hypothesis," proposed by Schwendener.——The death of the following botanists has recently been announced: Elisabetha, Contessa Fiorini-Mazzanti, author of many papers on Algæ, etc.; of Thilo Irmisch, well known for his memoirs on the morphology of Phanerogams; of E. Spach, a voluminous author of systematic works and papers; of Prof. Karl Koch, of Berlin, best known as a horticultural botanist, as was David Moore, the well-known director of the Glasnevin Botanic Gardens, Dublin, who died June 9th at the age of seventy-two years; Tilbury Fox, M.D., who had given attention to the part played by minute fungi in producing skin and hair diseases, died at Paris, June 7th. We may add to the list Wm. Schimper, who, according to Gray, was the schoolmate of Agassiz, and one of the first investigators of phyllotaxy; he spent most of his life in Abyssinia.

ZOÖLOGY.[1]

THE SPADE-FOOT TOAD IN NEW HAVEN, CONN.—For more than two years I have been looking for the "spade-foot" (*Scaphiopus holbrookii*) in and about New Haven, confident that it occurred here and that careful search would reveal it; but my efforts have been vain until very lately. Thursday, April 24th, I saw some children gathered around an object on the pavement of Prospect street, and I asked them what they had. They replied that they had dug up a toad in the next yard. You can imagine my surprise and delight to behold a real live "spade-foot," the first I had ever seen alive. They willingly gave it to me, and I carefully took it home with me and kept it alive in a large box with plenty of earth and a tub of water.

Tuesday morning (the 29th) I was shooting small birds near Fair Haven, when I heard a most peculiar bellowing from a pond near by. I am more or less familiar with all the ordinary sounds that come from a pond, and I jumped at the conclusion that I heard the "spade-foot." On reaching the pond I saw a sight I shall never forget; the pond was rather small, and was swollen and overflowing on account of the heavy rains of the two preceding days, and swimming all over the surface, and at times uttering their peculiar bellow, were forty or fifty of my long-sought friends. They would float or swim awkwardly along until they wished to favor me with a song, and then the accommodating soloist would suddenly assume a perpendicular position as if a plummet had been attached to his tail, his head alone show-

[1] The departments of Ornithology and Mammalogy are conducted by Dr. ELLIOTT COUES, U. S. A.

ing above the water, his white throat dilated till it was three times the size of the head, his mouth closed tight, he would sing his brief song and reassume his horizontal position. The pond was quite deep in the middle, but I secured some specimens to prove my statements on my return home.

When I passed the pond again in the afternoon the same programme was being carried out, but I could secure no more specimens. On my return home I put my toad with the one I found Thursday, and in a few moments the male (the last caught) had clasped the female very tightly and I was expecting to raise some tadpoles, but they buried themselves in the earth the next day without laying any eggs.

In the afternoon of Tuesday a friend of mine, Mr. W. H. Fox, found the Scaphiopus in a pond out on Prospect street, and secured quite a number of specimens together with some spawn which he thinks belongs to this toad.

The next day (Wednesday, April 30th) I visited my pond again with net and pails, but the birds had flown without leaving a sign. Not a toad was to be seen or heard, and no spawn but frog spawn could be found; but they may have dropped it in the deeper water in the middle of the pond, out of my reach and sight. Mr. Fox visited his pond also Wednesday, but could not find a toad except the common one (*Bufo americanus*).

When I brought my first specimen home she buried herself in the earth, but when I returned from Fair Haven she was swimming around in her tub of water like the rest of them, and when I put the male in they stayed in the water together. Wednesday morning when the toads in the two ponds had disappeared, my pair had also buried themselves again in the earth in their box. So I think I can judge of the movements of the free toads by watching the movements of my captives.—*Fred. Sumner Smith.*

The Shedding of the Tracheæ and Double Cocoons.—It is a physiological rule in insect growth that the lining of the tracheæ, and of such other parts as are more or less subject to the action of the air, is shed with the external skin. This is the case even with those ramifications of the tracheæ where the lining is not so fine as to be absorbed. I was somewhat surprised, therefore, to find Mr. Edward Potts, in a late number of the Naturalist, recording the fact as something interesting and new.

The same remarks apply to his observations about finding two chrysalids in a single cocoon of *Bombyx mori*. These so-called double cocoons are of very common occurrence, mentioned centuries since in works on silk culture, and noticed by every one who has had much to do with the rearing of silkworms.—*C. V. Riley.*

Relations of the Ctenophora to the Jelly Fishes.—Hæckel has recently published a paper in the Jena *Zeitschrift*, in which he describes and figures *Ctenaria ctenophora*, a medusa of

the family *Cladonemidæ*, which has an oval body with two long ciliated tentacles, causing it to strangely resemble the Ctenophore Cydippe or Pleurobrachia. Ctenaria inhabits the Pacific ocean, and is regarded by Hæckel as an immediate transitional form from Gemmaria-like Anthomedusæ to Cydippe-like Ctenophora. A full description and drawings will be published in a work soon to appear entitled "System der Medusen," to be illustrated with forty plates. He considers that the Ctenophora have originated from the order of Anthomedusæ and family Cladonenidæ, and adds a table showing the homologies between the Ctenophores and the Craspedote Acalephs.

Swimming Polypes in Deep Water.—Till recently the free-swimming polypes met with at sea, of which the Portuguese man-of-war is a familiar example, were thought to tenant only the parts close to the surface. The hydrostatic air bladder found in many of them, and its nature, sometimes quite transparent, sometimes more or less blue, were in keeping with this kind of life. Exceptions to the rule, however, are now known to occur. In 1875, when the broken Atlantic cable was being recovered, living polype-like creatures were brought up from a depth of 1780 fathoms. Dr. W. Siemens presented them to the Zoölogical Museum in Berlin. More recently Prof. Studer, on board the German ship *Gazelle*, obtained several specimens, complete and fragmentary, from the deep water, and was able to examine some of the animals while still alive. Twenty-four such cases he records. The depth of sounding line at which these siphonophora were attached were more than 300 fathoms; eleven were brought from 1500 to 2000 fathoms, and six from less than 800. Dredges in operation at the same time to 200 fathoms depth brought in no such animals, and it is inferred that those caught could not have merely got attached in lowering or raising the line. The animals belonged to the known genus Rhizophysa, and a new one (Bathyphysa). They had comparatively small swimming bladders, but no bells. Prof. Studer notes that a depth of 1000 fathoms (the average in this case) corresponds to a pressure of 181.85 atmospheres. Water would hardly be condensed at this, but the gas in the bladder of course would. Still, supposing it atmospheric air, its specific gravity when so condensed (0.235) would still be considerably under that of the sea water (1.027). The gas in the bladder, in its efforts to expand, would balance the pressure of the water column. But the animal by contracting the muscular walls of the bladder, may condense the air more and so sink; or, by releasing the contraction, raise itself. Only, in order that the volume of the gas should keep proportional to the pressure, the bladder must not come into too high layers of water, else it will be in danger of bursting. This, indeed, seems to have occurred with Siemens' Bathyphysa.—*English Mechanic.*

CAPTURE OF A SAW-FISH.—When riding on the beach at Galveston, Texas, on the 1st of April last, I noticed some Mexican fishermen drawing a seine to shore to which was attached a large saw-fish (*Pristis antiquorum*). The animal was not enclosed within the net, but some of the meshes had become engaged with the teeth of the saw, and by this attachment it was drawn several hundred feet towards the shore, the large dorsal fin alone showing above the water suggesting that a shark was entangled in the net, but if a shark it must have been a dead one, for not the least effort at resistance was made, nor even signs of life, for the object drifted in as lifeless as a log till it touched the bottom; then indeed it made a few spasmodic efforts showing terrific power, in which the head and saw were thrown high into the air and swung around in a fearful way, while the tail was lashed about, showing that a bullock could not have withstood the blows.

This demonstration did not last five seconds, but it had brought the monster considerably nearer the shore and into about one foot of water where she lay perfectly quiet. The Mexicans then cautiously approached and slipped a noose over the tail, which was very broad, though the body just above it was but a few inches in diameter. When an attempt was made to pull her to shore, she made one more effort though but for an instant, when she quickly resigned herself to her fate. After she was nearly clear of the water eight men could not pull her more than one foot at a time, but she was finally landed well up on the beach. I did not venture near enough to measure her, but judged her body was eleven feet and her saw four feet long. At the shoulders I judged she was eighteen inches broad; thence it gradually tapered to the tail.

The extraordinary feature was the immobility of the animal under the circumstances; she was drawn in several hundred feet by a twine not larger than a knitting-needle, and she suffered herself to be dragged through the sand, tail foremost, without the least effort at resistance, or the least motion to show that she was suffering. I would like to know if this is usual with this fish when captured?

I learned that three well-grown fœtal saw-fish were found in her.—*J. D. Caton.*

INTELLIGENCE IN CANTHON.—The observation of Mr. Powell in your May number (page 124) on earth-worms reminded me of a similar display of reason in a *Canthon volvens*, which I think is worthy to be noted. One summer day I took a walk in the woods and met a beetle of the above kind singly pushing forward its ball in a straight direction, when it arrived at a certain point there was a slight declivity and the ball rolled sideways down about a yard; the beetle followed, and reaching the ball mounted and looked around. Then it descended and went to work again,

moving the ball at a large angle to a point about one and a half yards forward of the point, where it deviated and then proceeded in the original direction to a heap of dry leaves; it stopped pushing, entered the heap and commenced to pull the ball in. Evidently the beetle mounted the ball as a lookout for the right way. I was astonished, and if told should hardly have believed it, but I saw it.—*Fred. Brendel, Peoria, Ill.*

THE CALIFORNIA GRAY WHALE.—A schooner load of bones of this species, gathered in Scammon's Lagoon, Lower California, recently arrived in San Francisco, and were sold to be ground as fertilizers. Having examined a large number of the bones I can complete the characters of the genus *Rachianectes*, which have been but imperfectly known. The cervical vertebræ are all distinct, and the second and third at least enclose a vertebral canal. A first rib (the only one not broken up) has two heads; two other short ribs, perhaps first and second, are united distally into a broad sheet of bone. It is uncertain how far the union of these ribs is constant. The scapula has both coracoid and acromion. The orbital process of the frontal is of medium width, somewhat as in some species of *Megaptera*.—*E. D. Cope.*

THE JAPANESE LAP DOG (*Dysodus pravus*).—Since describing this form (Proceedings Academy, Philadelphia, July, 1879), I have had the opportunity of examining three other specimens in San Francisco. The first, which is in possession of Mrs. E. H. Harford, presents the following dental formula: I. $\frac{3}{3}$; C. $\frac{1}{1}$; Pre-m. $\frac{4}{3}$; M. $\frac{2}{2}$. The animal is young, as the exterior cusps only of the second superior tuberculars protrude through the gum. There is no internal tubercle of the inferior sectorial. The first superior premolar is a rudimental cusp; the second is very small, while the third is subtransverse in position. The dog is said not to be of pure race, which, perhaps, accounts for the presence of an additional premolar in each jaw. There are still one less below than in *Canis*, and will probably be early shed.

A second specimen, in possession of Mrs. Sargent, has the typical dentition: I. $\frac{3}{3}$; C. $\frac{1}{1}$; Pre-m. $\frac{2}{2}$; M. $\frac{2-1}{2}$. It is also young, as the milk inferior sectorial dropped from the gum as I examined it, and the outer edge of the second superior tubercular only is exposed. Curiously enough there is an inner tubercle of the inferior sectorial. This dog came from Yokohama, and is said to be pure. Its age is said to be three years and three months; it has been in possession of Mrs. Sargent two years.

The third specimen is of larger size, and is said to be ten years old. Its dental formula is I. $\frac{0}{1}$; C. $\frac{1}{1}$; Pre-m. $\frac{4}{4}$; M. $\frac{1}{1}$; no inner tubercle of inferior sectorial. The last true molar above has been shed, but the alveolus remains; this and the loss of the inferior incisors are characters plainly due to old age.

The above examples all maintain the characters of the genus

Dysodus. The hair of this species is rather long and is not curled, and is neither very coarse nor fine. Ears pendant. The colors in the three specimens are black and white, the former predominating in one, the latter in another.

The extra copies of the paper in which this species was described were issued during my absence from home, so that their date of publication was unfortunately omitted; this is August 23, 1879.—*E. D. Cope.*

ZOÖLOGICAL NEWS.—*The Rural Press*, August 2d, contains descriptions read before the Californian Academy of Sciences. It is unfortunate that these descriptions should appear in this heterodox manner, and we would urge the author to send his descriptions to some recognized scientific publication, where they may meet the notice of ichthyologists. The new forms are *Glyptocephalus zachirus*, *Chitonotus megacephalus* and *Caulolatilus princeps*, all from the Pacific coast.——A zoölogical station has been established in Scotland at Cowie, near Stonehaven, the work to be carried on under the direction of Mr. G. J. Romanes, in connection with Aberdeen University.——Dr. J. F. Brandt, the veteran Russian naturalist of St. Petersburg, died August 7th, aged 77. He left valuable manuscripts which will be published.——Prof. Allman's address as president of the British Association, began at Sheffield, August 20th, was on protoplasm.——Cobbold's Parasites: a treatise on the Entozoa of man and animals, will prove useful to students and medical men.——A reply to Principal Dawson's criticism of Mœbius' work on Eozoön by Mœbius himself appears in the *American Journal of Science* for September. ——Lubbock's scientific lectures just published by Macmillan & Co., will interest zoölogical students.——Mr. Moseley's Croonian lecture for 1878 was on the Stylasteridæ, a family of Hydroid stony corals.

ANTHROPOLOGY.[1]

ANTHROPOLOGICAL NEWS.—The second number of *Revue d'Anthropologie* for 1879 contains several papers of great importance. The first one is that by M. Florentino Ameghino upon pre-historic man in La Plata. The article is based upon an anthropological exhibit in the late Paris Exposition from the Argentine Republic. The author prefaces his discussion of the antiquity of man in La Plata with a chapter upon the American Aborigines, their antiquity and origin, in which he has brought together with rare diligence, from many literary sources, theories and statements concerning his subject. While many of these unproved opinions are stated only to be repudiated, others are retained and used as the bases of arguments which have no value whatever. The following story will suffice as an example: The Scandinavians were preceded by the Irish. An Irishman named Ari was driven by a tempest to

[1] Edited by Prof. OTIS T. MASON, Columbian College, Washington, D. C.

Huitramanaland, or later, in 999, he was seen by Biorn Asbrandson, a person who figures in the history of Scandinavia. And recently has been found near the Potomac, twenty kilometres from Washington, the burial place of Syasi, a woman that an ancient Irish manuscript, anterior to the year 1057, speaks of as having been killed by the Skrellings (Esquimaux) in an expedition to Huitramanaland. The grave was indicated by the following inscription: "Here rests Syasi, the blonde, from the eastern Island, widow of Kjoldr, sister of Thorgr by his father, aged 25 years. God be gracious to her. 1051."

It would be exceedingly unfair to judge of M. Ameghino's second and third chapters by the first, though the strong tendency is to believe that if he is so unreliable with reference to those things with which we are familiar, he is not to be trusted on ground unfamiliar to us. In fact, M. Ameghino is at home in La Plata, and speaks *ex cathedra*, while in the former chapter he quotes from others. The following is the author's classification of the archæological epochs:

Geological epochs.	Geological periods.	Archæological Epochs.	Sub-periods.
Post-tertiary	Post-pampean	Neolithic	Modern and ancient times
		Mesolithic	Mesolithic times
	Pampean	Paleolithic	Times of the great lakes
			Modern pampean times
			Ancient pampean times

A perusal of the paper will soon convince one that diligent workers are not wanting in South America; and omitting the worthless stories in the first part of the communication, the author's researches are to be highly commended.

The paper on the ancient inhabitants of the Canaries, by Dr. Verneau, and that on the series of the crania of assassins deserve careful study.

The able reviews by the most distinguished anthropologists of France, the miscellaneous notes and the bibliography make the *Revue d'Anthropologie* an indispensable auxiliary to the student of our favorite science.

The *American Antiquarian* has reached its fourth number and completed its first year. The contents of the present number are as follows: The emblematical mounds of Wisconsin, by J. N. De Hart, M.D.; Shell beds of Clatsop beach, by H. B. Clarke; A comparison between the the archæology of Europe and America, by the editor; The Utes of Colorado, by N. C. Meeker; Early Indian migrations in Ohio, by C. C. Baldwin; An exhibition of Indian character, by W. L. Coffinbury; The discourse of Dr. Broca at the opening of the International Congress of Anthropological Science in connection with the Universal Exposition at Paris, August 16, 1878; Indian music, by Rev. M. Eells; Pre-

historic manufacturing village in the Miami valley, by I. H. Benkley. The usual amount of current notes closes the volume.

The editor, in his letter to contributors, says that in the editorial department the *Antiquarian* has succeeded beyond his expectations. Of course magazines cannot be run without money, and in this regard the friends of anthropology must stand by the magazine.

The editor of these notes in the NATURALIST, under the kind favor of Prof. Baird and Major Powell, has been engaged in collecting materials for an atlas of North American antiquities and a dictionary of North American Indians. For the purpose of encouraging the former the Smithsonian Institution has issued a pamphlet of directions to observers, which can be obtained in any number by writing to the Smithsonian Institution. The work on the latter, or the dictionary of tribes, has reached the astounding number of ten thousand names. Of course there were never that many tribes in North America, but some tribes have nearly a hundred names. These names are of two kinds, autonyms and heteronyms. The former may be tribal or consanguineous, the latter may be Indian or Aryan, and either may be contemptuous or descriptive. The Aryan names have the further embarrassment of being written in English, French, Spanish and Dutch, and not always on the same phonetic system at that. Such papers as that of Mr. C. C. Baldwin in the *Antiquarian*, are of incalculable value to the summarist, and we take this method of expressing our thanks and calling for more.

Mr. E. A. Barber, in charge of the archæological department, Permanent Exhibition, Philadelphia, has gone to work in earnest to make his portion of the exhibition a success. It is the intention of the Council to establish a permanent loan exhibition of prehistoric relics; by which is meant that the exhibition and not the loan is to be permanent. Every guarantee of safe return of specimens is promised, and the exhibition will, no doubt, be successful.

The Appletons have brought out in good style, Hæckel's Evolution of Man, a review of which by Mr. Lester F. Ward was noticed in the July number of the NATURALIST. It is impossible in a short notice to review a work of such magnitude. No doubt it is a most exhaustive treatise on the biology of the human race, and the scientific reputation of the author must give it a wide circulation. The author's opinion "that a really scientific study of nature can no more dispense with philosophic reflection than can healthy philosophy ignore the results of natural scientific experience," leads him to apply his theory to all phenomena, material and spiritual. Furthermore, the political influence of the clergy in Germany has brought them into sharp conflict with men of science and politicians. The work of Prof. Hæckel is filled with bitter invective, which is little appreciated in a land of free thought, free speech and free religion.

The first number of the *Folk Lore Record*, published by the Folk Lore Society of London, is a charming volume on a delightful subject. The following papers are given in this number: Some West Sussex superstitions lingering in 1868, by Mrs. Latham; Notes on folk tales, by W. R. S. Ralston; The folk lore of France, by A. Lang; Some Japan folk tales, by C. Pfoundes; A folk tale and various superstitions of the Hidatsa Indians, by E. B. Tylor; Chaucer's night spell, by William J. Thoms; Plant lore notes to Mrs. Latham's West Sussex superstitions, by James Britten; Yorkshire local rhymes and sayings; Divination by the blade-bone, by William J. Thoms; Index to the folk lore in the first series of Hardwick's Science Gossip, by James Britten; Some Italian folk lore, by Henry Charles Coote; Wart and wen cures, by James Hardy; Fairies at Ilkley Wells, by Charles C. Smith; Notes; Queries; Notices and News.

Our readers will be pleased to hear that Maj. Powell, Col. Garrick Mallery and Mrs. A. R. Marvine are rummaging the entire literature of North American Aborigines with a view to publishing an exhaustive work on American Indian mythology.

The February number of *Materiaux pour l'Histoire de l'Homme* contains a very good résumé of the meeting of German anthropologists in 1878. The rest of the number is occupied with local European archæology.

In No. 5 of *Correspondenz-Blatt* Prof. Stieda reviews a work entitled Materialen zur Vorgeschichte des Menschen im östlichen Europa. Nach polnischen und russischen Quellen bearbeitet und herausgegeben, von Albin Kohn und Dr. C. Mehlis. Jena, Costenoble, 1879.

GEOLOGY AND PALÆONTOLOGY.

Development of the Trilobites.—The Utica Slate and related formations. Fossils of the Utica Slate and metamorphoses of *Triarthrus becki*, by C. D. Walcott. (Transactions of the Albany Institute, Vol. x, p. 38, pls. 2.) The author in the above-mentioned articles gives the known distribution of the rocks of the Utica slate and a comparison of it with the Galena limestone, the Triarthrus beds of Cincinnati, the Orthis bed of Tennessee, the Thebes sandstone and the Graptolitic shales of Virginia, Tennessee and Alabama. The author is opposed to applying the term Cincinnati "to any group, epoch or period of Lower Silurian rocks." In the second part are given descriptions of two new genera and ten new species, making a total of one hundred species now known from the Utica slate. The development of the trilobite, *Triarthrus becki*, is given nearly complete. Barrande has classified the modes of development of the trilobites into four orders: 1st. Head predominating, incomplete; thorax rudimentary or wanting; pygidium wanting. 2d. Head distinct, incomplete; thorax wanting; pygidium distinct, incomplete. 3d. Head com-

plete; thorax distinct, incomplete; pygidium distinct, incomplete. 4th. Head and thorax complete; pygidium distinct, incomplete.

With regard to *Triarthrus* our author says: "We find *Triarthrus becki* placed doubtfully at the end of the third order on the description given by Prof. Hall. We cannot remove it from that position, as the youngest stage we have shows one segment in the thorax, but from the changes that occur in its development we cannot avoid the conclusion that with more complete material it will be removed to the second order, as the smallest individual is one millimetre in length, and the head and pygidium are strongly lobed and well developed." Two beautiful plates illustrate the new species and the various stages of the trilobite.—*J. S. K.*

GEOGRAPHY AND TRAVELS.[1]

AFRICAN EXPLORATION.—The Portuguese are about sending out another expedition, under Capt. Paiva d'Andrada. This party is to continue the exploration of the Zambesi river, and to form commercial and agricultural colonies in the neighborhood of Tete and the abandoned station of Zumba, which was once the furthest point occupied by the Portuguese on the river.

The party sent out from Livingstonia in August, 1878, to explore the western shore of lake Nyassa, after reaching Kuta bay, as mentioned in the NATURALIST for June, 1879, returned home, part of the way by another route, reaching Livingstonia on November 9th. Another attempt is soon to be made by the missionaries to obtain a better site for their station than the present one. They hope to find it between the Nyassa and the Tanganyika.

The East African Expedition of the R. G. S., under Mr. Keith Johnston, left the coast for the interior on the 19th of May. The natives in his employ numbered 138. He communicated to the society the route which he intended to take,[2] and upon which he was to proceed south-westwardly from Dar-es-Salaam, and would be likely to obtain abundant supplies of food. He had previously made a short trip to Usambara. "This journey," he remarks, "furnishes an excellent specimen of the sort of traveling we shall have, and took us through a country which may be taken as an epitome of all Africa. There was a little bit of arid, level, uninhabited desert, a bit of undulating, cultivated and populous country, and beyond that a tract of mountain forest and stiff climbing. The magnitude of the trees and the density of the forest exceeded anything I had imagined in Africa, and reminded me of Northern Paraguay, only here there is much less variety in the tree forms."

But this expedition, starting under such favorable auspices, has already been deprived of its young and most capable leader.

[1] Edited by ELLIS H. YARNALL, Philadelphia.

[2] Proceedings of Royal Geographical Society, July, 1879.

Mr. Johnston died from dysentery, at Berobero in Khutu, 130 miles from Dar-es-Salaam, on the 28th of June.

We have also to record the death, on the 10th of July last, of the Rev. Dr. Mullens, who left England in April of this year to reorganize the Tanganyika Mission of the London Missionary Society.

The *Academy* states that the Universities' Mission in Eastern Africa have recently established a new station at Newala on the river Ruvuma, forty miles nearer lake Nyassa than their original settlement at Masari.

The Abbé Debaize arrived at Ujiji on April 2d. He intends to establish a depot in the Uzighé country at the north end of lake Tanganyika. He then expects to be able to establish another station at the mouth of the Aruwimi, on the Congo—a very bold and hazardous undertaking. He will then explore the countries between the southern end of the Albert Nyanza and lake Tanganyika. It is much to be desired that the very good fortune that has so far attended him will continue to be enjoyed by this intrepid and skillful leader of the French Scientific Expedition.

The Belgian Expedition was, at last accounts, concentrated at Tabora, where they expected to remain until the end of the rainy season in May. An entomological collection has been forwarded by Dr. Dutrieux. The Belgian Society have chartered a steamer to take out supplies for the expedition to the mouth of the Congo. A small steamer in sections, three steam launches and three flat bottomed boats, none of which will draw more than a foot of water, are also sent. This little flotilla is commanded by Capt. Loesewitz, who has a crew of forty seamen accustomed to a tropical climate and engaged for three years. It is hoped thus to reach a point where M. Cambier and his party can communicate with them. It is further reported that Mr. H. M. Stanley, after having made rapid surveys of the streams emptying on the east coast near Zanzibar, and engaging a large number of his old followers has left Zanzibar, and is expected to take command of this section of the Belgian expedition.

The French Algerian Missionary parties have each reached their respective destinations on the Victoria Nyanza and the Tanganyika lake. The Victoria party are reported to be very destitute. They have heard of the arrival of the Church Missionary Society's reinforcements at Uganda from Egypt and the Nile. Another band of priests is to leave Algeria shortly to join their companions.

The Church Missionary Society has established a permanent station at Mpwapwa, where they have twenty-five acres of land under cultivation. This is topographically the most important place between the coast and Unyanyembe, as all the caravan roads converge to it. Its elevation above the sea is 860 metres. Two more of the agents of this society have reached the southern

extremity of the Victoria Nyanza. A recent number of the *Church Missionary Intelligencer* gives an account by the Rev. C. T. Wilson of his voyage across the great lake from Uganda to Kagei. South of the Kagera or Kitangule river the low forest-covered shore gives place to high downs ending in abrupt precipices 300 or 400 feet high. North of the Kagera the rocks are mostly a hard conglomerate, the matrix being a clay iron ore, in which quartzite pebbles were imbedded, but on the south they are clay slate with red sandstone, the strata being inclined in a westerly direction at an angle of about fifteen degrees.

The American Board of Foreign Missions having recently received a large bequest, is desirous of establishing a mission in Africa, but finds nearly every portion of the coast occupied or at least prospected! They will probably choose a site in the interior where certainly there can be no difficulty in finding an unoccupied field.

The King of the Belgians has presented the International African Association with four Indian elephants. They have arrived safely at Zanzibar from Bombay, and have been landed near Dar-es-Salaam. An elephant will convey fifteen ordinary porters' loads of sixty pounds each, so that seven elephants would be able to carry as much as one hundred porters.

OBITUARY.—The following appeared in the London *Athenæum* of August 9, 1879: "Mr. Keith Johnston is no more. A son of the eminent geographer, Alexander Keith Johnston, the deceased gave early promise of fulfilling to the utmost the expectations of his friends. Carefully trained under the eye of his father and at Perthes's Geographical Institute under Dr. Petermann, he exhibited equal skill as a compiler of maps and a writer on geographical subjects. Amongst his latest works are a volume on 'Africa,' recently published by Mr. Stanford, and a 'Book of Physical Geography,' intended for the use of schools. An expedition to Paraguay showed that he also possessed the qualities demanded of a geographical explorer, and the work then done by him fully justified the choice of the Royal Geographical Society when they placed him at the head of an expedition intended to explore the country between Dar-es-Salaam and lake Nyassa. His report on a preliminary trip to Usambara gave promise of an exhaustive and trustworthy account of his further researches, such as is but rarely furnished by African 'pathfinders.' It was not to be. Still a young man, not yet thirty, he has joined that band of noble men who have laid down their lives in the cause of African exploration."

MICROSCOPY.[1]

AMERICAN SOCIETY OF MICROSCOPISTS.—This society assembled in Buffalo on Tuesday morning, August 19th, and adjourned on Friday noon, the 22d. About sixty members were in attendance.

[1] This department is edited by Dr. R. H. WARD, Troy, N. Y.

Important amendments were agreed upon to the proposed Constitution, and it was then adopted without opposition. At the suggestion of the National Committee on Micrometry, last year's resolution favoring the one-hundredth millimetre as the unit for micrometry was reconsidered, and the whole subject was then referred to the committee for further action. Mr. E. H. Griffith offered a silver medal as a prize, to be awarded at the next annual meeting, for the best two slides illustrating the adulteration of some common article of food. On Thursday evening a soirée was held in St. James Hall, which was well attended by the citizens of Buffalo. The following officers were elected for next year's meeting: President, Prof. H. L. Smith, of Geneva, N. Y.; vice-presidents, Dr. W. W. Butterfield, of Indianapolis, and Mr. C. C. Merriman, of Rochester; secretary, Prof. A. H. Tuttle, of Columbus, O.; treasurer, Mr. George A. Fell, of Buffalo. The day and place for the next meeting were left to be selected and announced by the Executive Committee. The president's address was delivered on Tuesday evening by Dr. R. H. Ward, in St. James Hall. During the week the following papers were read: On *Lernæocera cruciata*, and also on certain crustaceous parasites on fish, by Prof. D. S. Kellicott; on the structure of the spinal cord in the marsipobranch fishes, by Prof. A. H. Tuttle; on the embryonic growth of the eustachian tube and middle ear, by Dr. Lucien Howe; on photography as an aid to microscopical investigations, by Dr. Carl Seiler; on Modern object glasses, and on a universal microscope stand, by Prof. J. E. Smith; on the systematic examination of objectives for the microscope, by Dr. G. E. Blackham; on the Preparation and mounting of double stainings, by Mr. C. C. Merriman; on the Microscopical examination of the nerve centres, by Dr. Theo. Deecke; on the Microscopical work at the Department of Agriculture, by Thos. Taylor; on the Destructive powers of certain insects, by Mr. C. M. Vorce; on Microscopical organisms in drinking water, by Prof. S. A. Lattimore; and on the Illumination of fine rulings, by Dr. W. B. Rezner. After adjournment the few members who were able to remain for that purpose, enjoyed a most agreeable excursion to Niagara Falls as the guests of the citizens of Buffalo, of whom many of the most cultivated and accomplished accompanied the party.

American Association for the Advancement of Science.—This great society held one of its most successful meetings at Saratoga Springs during the week commencing August 27th, under the presidency of Prof. Geo. F. Barker. More than one hundred and fifty papers were presented, many of them being of exceptional value. Among those pertaining to microscopy may be mentioned those on the Physics of microscope objectives, by Romyn Hitchcock; on the Histology of insects, by Chas. S. Minot: on a Standard meter and its subdivisions into equal parts,

and on First results from a new diffraction ruling engine, by Prof. Wm. A. Rogers; on Crystallization of Canada Balsam, by Prof. Geo. F. Barker; on the Occurrence of microscopic crystals in the vertebra of the toad, by Prof. H. Carrington Bolton. Prof. S. A. Lattimore was elected chairman, and Rev. A. B. Hervey, secretary of the sub-section of microscopy for the next meeting, which is to be held in Boston, commencing on the last Wednesday in August next, and which can hardly fail to be a large and enthusiastic assemblage.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, Twenty-eighth meeting, Saratoga, Aug. 27 to Sept. 2, 1879.—Owing to the favorable place of meeting, the gathering of members was larger than for several years, nearly 260 members being present, and 154 papers, some of unusual interest, having been entered. Prof. O. C. Marsh, president of the St. Louis meeting, read an address as retiring president, on the History and Methods of Palæontology. Prof. George F. Barker, as president, made a brief introductory speech at the opening of the session. The following papers on biology, geology and anthropology were presented:

The succession of glacial deposits in New England	Warren Upham
On the thinning out and absence of the Upper Silurian and Devonian formations in Tennessee. On a remarkable crinoidal form recently discovered in Tennessee, with exhibition of specimens	J. M. Safford
Recently discovered cupreous veins at Blue Hill, Me. The Green mountain anticlinal	C. H. Hitchcock
Consonantal expression of emotion	Clarence J. Blake
On the fertilization of Yucca. Objects of sex and of odor in flowers	Thomas Meehan
Philosophy of the pupation of butterflies, and particularly of the Nymphalidæ. The cotton worm in the United States; explanation of its work, and mooted points in its habits cleared up	C. V. Riley
On the conditions to be fulfilled by a theory of life. On the histology of insects. On the anatomy of Plathelminthes	Chas. Sedgwick Minot
A short biography of the Menhaden	G. Brown Goode
Practical illustration of the use of some new or little known anatomical and physiological instruments and apparatus. Notes on the anatomy of the cat's brain. On a cat's brain with the corpus callosum absent	B. G. Wilder
On the occurrence of microscopic crystals in the vertebra of the toad (*Bufo americanus*). [With a note by A. A. Julien.]	H. Carrington Bolton.
The ethnical influences of physical geography	Danl. Wilson
The development of the neuration in the wings of insects, as illustrated in the history of cockroaches	S. H. Scudder
On graphite from the Ducktown copper mine	W. L. Dudley
On the geology of Bermuda	Wm. North Rice
Sexual differentiation in *Epigæa repens*. Homologies in the Lauracæa. Note on the movement of the stamens of *Sabbatia angularis*	Lester F. Ward
On the Triassic rocks of New Jersey	Geo. H. Cook

An apparatus for photographing natural history objects in a horizontal position. The inter-articular ligaments of the head of the ribs in the cat. A method of demonstrating the thoracic arch in animals..... S. H. Gage

The bud-blight insect. Some interesting insect habits and their development. A successful moth trap..... W. S. Barnard

On the present condition of the work upon the palæontology of New York. Notes upon the genera Fenestella, Hemitrypa, etc. The fauna of the Lower Helderberg group in relation to the corals, Bryozoa and Echinodermata..... James Hall

On the molluscan dredgings in the Gulf of Mexico and vicinity by the U. S. Coast Survey steamer *Blake* in 1877–9. On the genus Pleurotomaria..... Wm. H. Dall

Gypsum sand..... A. P. S. Stuart

The geological action of the acid of Humus: I. On unconsolidated deposits; II. On solid rocks..... Alexis A. Julien

On some pre-Cambrian rocks in America and Europe. On the geology of Port Henry, N. Y..... T. Sterry Hunt

On the anthracite coal fields of Pennsylvania and their rapid exhaustion..... P. W. Sheafer

The newly discovered cave in Luray, Page county, Va.....Jno. W. Chickering, Jr.

A new form of unpolarizable electrodes for physiological research..... H. P. Bowditch

On the species of Bornean orangs, with notes on their habits; illustrated by specimens..... Wm. F. Hornaday

The Interoceanic Canal problem..... Edward P. Lull

On the progress of the Second Geological Survey of Pennsylvania..... J. P. Lesley

Notice of the occurrence of rocks representing the Marcellus shales of New York in Central Ohio..... R. P. Whitfield

The sign language of the North American Indians..... Garrick Mallery

Lake Erie and the Eries. Superstitions of the ancient inhabitants of the Mississippi valley relative to the rabbit. Superstitions among the ancient inhabitants of the Mississippi valley relative to serpents. Superstitions among the ancient inhabitants of the Mississippi valley relative to the owl. Superstitions among the ancient inhabitants of the Mississippi valley relative to thunder..... J. G. Henderson

Exhibition of archæological objects..... S. S. Haldeman

Archæology of Champlain valley, giving a general account of recent discoveries..... Geo. H. Perkins

Archæology of Missouri..... W. H. H. Russell

Notice of some deposits of alkaline salts in Idaho..... Henry B. Nason

Archæological notes from Japan..... Edward S. Morse

Description of a polished stone implement found in Monkton, Vt..... John M. Currier

The substances of amber and jade, illustrated by remarkable specimens..... Mrs. E. A. Smith

On the explanation of hereditary transmission..... Louis Elsberg

The ethnology of the islands of the Indian and Pacific oceans; illustrated by a large colored map..... Albert S. Bickmore

On some large and remarkable stone implements of the southern mound-builders. On the pottery of the southern mound-builders..... F. W. Putnam

The genesis of the serpentine of Reichenstein, etc. ..... R. B. Hare

On the surface limits of thickness of the Continental glacier in New Jersey..... J. C. Smock

The following officers of the association were elected for 1880, the meeting to be held at Boston, Mass.: President, Lewis H. Morgan, of Rochester; permanent secretary, F. W. Putnam, of Cambridge; general secretary, John K. Rees, of St. Louis; treasurer, William S. Vaux, of Philadelphia.

PROCEEDINGS OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, March 11.—The following papers were read: On the nudibranchiate gastropod Mollusca of the North Pacific ocean, by Dr. R. Bergh, and On the variability of *Sphæria quercuum* Schw., by J. B Ellis.

March 15.—Dr. H. C. Chapman presented a paper for publication entitled, Notes on Amphiuma.

April 25.—Papers entitled, Placenta of *Macacus cynomolgus*, by H. C. Chapman, and Description of new species of Chirocephalus, by John A. Ryder, were presented for publication.

April 22.—Mr. Ryder described a new Pauropod from Fairmount Park, which he named *Eurypauropus spinosus*.

April 29.—Prof. Cope discussed the ancestry of the Rhinoceros family in the light of new material recently obtained from the western Tertiary.

May 6.—Prof. Cope described a new Saurian under the name of *Camarasaurus leptodcirus*.

May 13.—Dr. Francis Dercum made a communication on the muciferous system of fishes, in which he sought to show their relation to the sensory system, as well as some new points in their structure.

May 20.—Prof. Kœnig made a communication regarding plastic clays in reference to their microscopic features.

May 27.—Dr. Dercum presented some farther results of his study of the muciferous canals.

June 3d.—Mr. Martindale recorded the fact of the abundance of *Volvox globator* in the hydrant water of Camden, N. J. Prof. Cope discussed the geological position of the White river freshwater beds, assigning them to the same position as the Oligocene of Europe. He also offered some observations on the genus *Anchitherium*, and characterized a new species as *A. præstans*.

June 17.—Dr. Leidy exhibited the plates of his new work on rhizopods from the report of the Hayden Survey, for the inspection of the members, and described a new form under the name of *Nebela retorta*. Prof. Cope exhibited a skull of the new fossil cat, *Nimravus brachyops*.

June 24.—Mr. Meehan called attention to a remarkable instance of variation in the ray-petals of the flower of *Lonas*, from none at all to a form as well-marked as in the ox-eye daisy. Mr. Ryder described the larva of his recently described *Eurypauropus*.

July 1.—Prof. Cope presented a paper on the genera of cats, in which a re-arrangement of the species was proposed on the characters presented by the form of the pupil of the eye and the specialization of the dentition.

July 8.—Dr. Leidy described and named a new fossil foot-track from the Pennsylvania anthracite coal shale. Prof. Cope discussed the principal characters of the genera of Canidæ, new generic names being proposed for two domesticated forms which constantly present remarkable peculiarities of dentition. The first was called *Synagodus*, the second *Dysodus*, each represented by one species which Prof. Cope believed had the same generic ancestry as other domesticated dogs.